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AERODYNAMIC HEATING COMPUTATIONS FOR PROJECTILES - VOL. II: SWEPT WING CALCULATIONS USING THE PLANAR VERSION OF THE ABRES SHAPE CHANGE CODE (PLNRASCC)

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This report documents modifications and additions incorporated into the ABRES Shape Change Code (ASCC80) to create a planar two-dimensional version of the axisymmetric computer code. This planar code predicts convective heat transfer and in-depth conduction for swept wings in supersonic flow. The report contains test cases and a detailed user's guide which describes the input data required to run the code.

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SECTION 1

INTRODUCTION

This report documents modifications and additions incorporated into the ABRES Shape Change Code (ASCC80)[1] to create a planar two-dimensional version of the axisymmetric computer code. This planar code predicts convective heat transfer and in-depth conduction for swept wings in supersonic flow. These planar modifications to ASCC80 were developed under the Aerodynamic Heating Computations for Projectiles program. The overall objectives for the program were threefold:

1. Modify the in-depth heat conduction package to improve ASCC's capabilities to handle slender multimaterial configurations
2. Extend the developments of planar ASCC modifications to predict heating of swept fin configurations to include: (a) turbulent flow on swept wings; (b) 2-D shock shape; and (c) improved in-depth heat conduction routines
3. Develop an interactive computational grid develping routine to simplify the procedure for specifying body configurations and developing computational grids for ASCC

The modifications made to ASCC80 covering the second objective are documented in Volume II of this report. Volumes I and III of this report document the work related to Objectives 1 and 3, respectively. In this

document, the updated ASC code is referred to as PLNRASCC, and the updated code associated with Objective 1 is referred to as BRLASCC.

Technical discussion of the PLNRASCC modifications is presented in Section 2. Section 3 is devoted to a discussion of input and output.

SECTION 2

TECHNICAL DISCUSSION

2.1 VISCOUS AND INVISCID FLOWFIELD MODIFICATIONS

Viscous and inviscid flow models for the ASCC80 version of the ABRES Shape Change Code[1] have been modified to solve a planar two-dimensional model for flow over swept wings. The theoretical basis for these swept wing modifications is described in a report by Suchsland.[2] Implementation into the PLNRASCC computer program is taken directly from that report. In addition, two new capabilities have been added to the fluid flow modeling in the computer code. The first is the ability to model two-dimensional shock shapes and include these effects in the boundary layer calculation. Suchsland's version of the code could only model shock shapes for axisymmetric configurations. The second added capability is the use of curve fitted pressure correlations for planar geometries. The earlier version of the inviscid flow model was restricted to axisymmetric body shapes.

The planar shock shape modifications to the code are a series of curve fits to computed results from a two-dimensional version of the RAZZIB[3] computer code. The RAZZIB code is a general inviscid flow solver for highspeed flight configurations. Pressure distributions were computed for a series of cylinder-wedge two-dimensional wings. Flow conditions for these test cases spanned a range of Mach numbers (M_∞ = 1.75, 2.0, 3.0, 4.0, and 6.0), and also a range of aft wedge angles (θ_W = 0.0°, 2.5°, and 5.0°). The

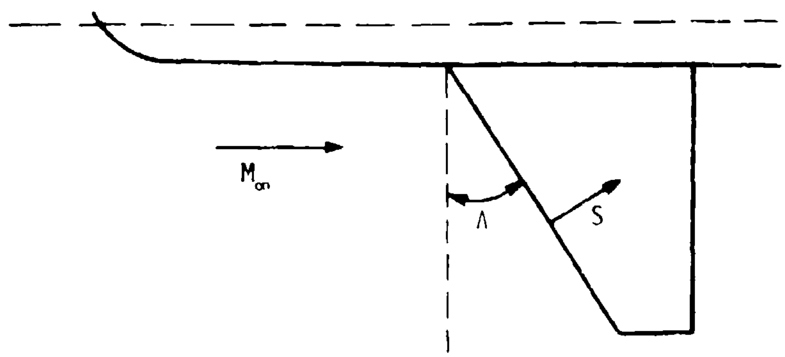


Figure 2-1. Sketch of swept wing geometry

computed results for shock angle, θ_W, versus X/R_i were fitted with a least squares sixth degree polynomial for each combination of wedge angle and Mach number and implemented into the BRLASC code. Internally, these curve fits are converted into tabular form. Linear interpolation in both wedge angle and Mach number is used to create the shock shape table for each new swept wing geometry. Note that in the case of a swept wing, the required shock shape is computed using the component of freestream Mach number that is normal to the leading edge of the wing.

The planar inviscid pressure correlations are also implemented in the form of curve fits to inviscid flow calculations. Results from the RAZZIB code were obtained for the same ranges of Mach numbers and wedge angles described above. Curve fits for P/P_0 versus X/R_i were produced using a combination of sixth degree polynomial and exponential least squares functions. Linear interpolation is used in both wedge angle and Mach number in order to produce a pressure ratio for each boundary layer integration point. As was noted above for the shock shape predictions, it is the swept wing's normal component of Mach number that determines where to interpolate in the pressure curve fits.

The new planar pressure correlations are only used on the aft wedge portion of the wing. The existing ASCC80 pressure correlations use modified Newtonian theory to predict the pressure distribution on the nosetip of an axisymmetric configuration.[4] Newtonian theory applies to planar geometries as well as axisymmetric ones. Thus the original pressure correlations were not altered in the nosetip region.

Planar input modifications to the BRLASC code are described in Section 3. This section should be used in addition to the user's manual in Volume I of this report in order to run the new code for planar swept wings. These input modifications enable PLNRASCC to be considerably more versatile and easier to use than Suchsland's original version of the code.

2.1.1 Results

This section gives convective heat transfer results from PLNRASCC and compares them with experimental data from a number of different swept wing configurations. These experiments were chosen to test the code for its ability to compute heat transfer in both laminar and turbulent boundary layers.

Figures 2-2 through 2-5 show predictions of the swept wing data of Stainback.[5] This experiment consisted of a 60° swept delta wing in a supersonic flow at several different tunnel stagnation pressures. The freestream Mach number for these data is 4.95. Laminar flow conditions exist for the entire run length of the wing. The "new prediction" in Figures 2-2 through 2-5 was produced using PLNRASCC. The "old prediction" is taken from Suchsland.[2] The differences between these two codes lie in the formulation of shock shape and inviscid pressure results for planar geometries. In Suchsland's prediction, he assumes a normal shock at the leading edge of the

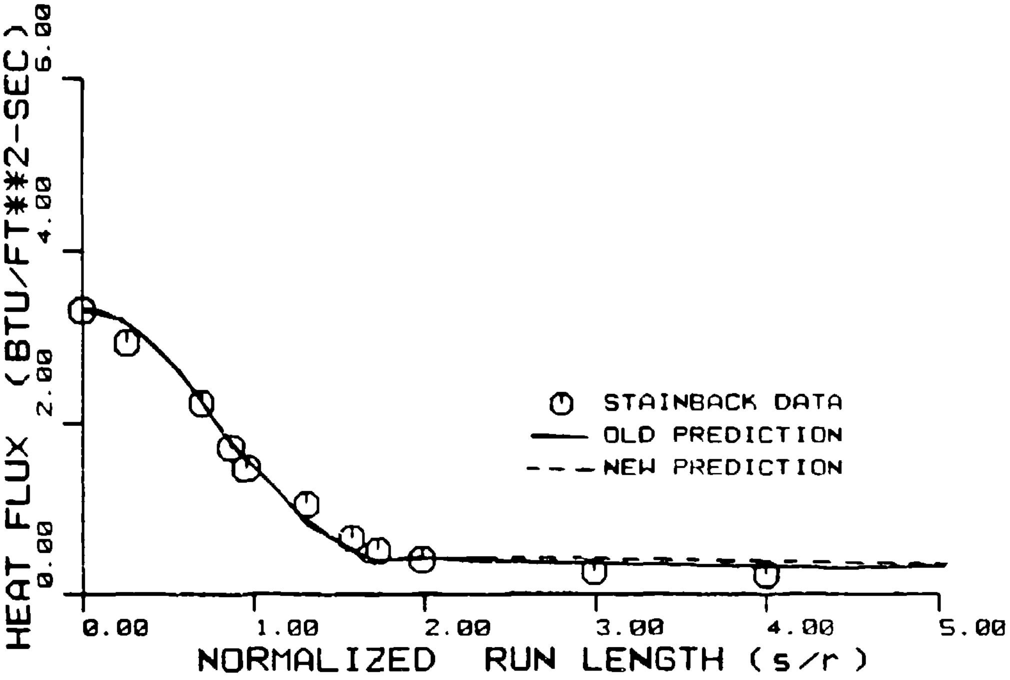


Figure 2-2. Heat transfer predictions of the experimental data of Stainback[5]
R_i = 0.25 inch, P_o = 428 psig, T_o = 460°F

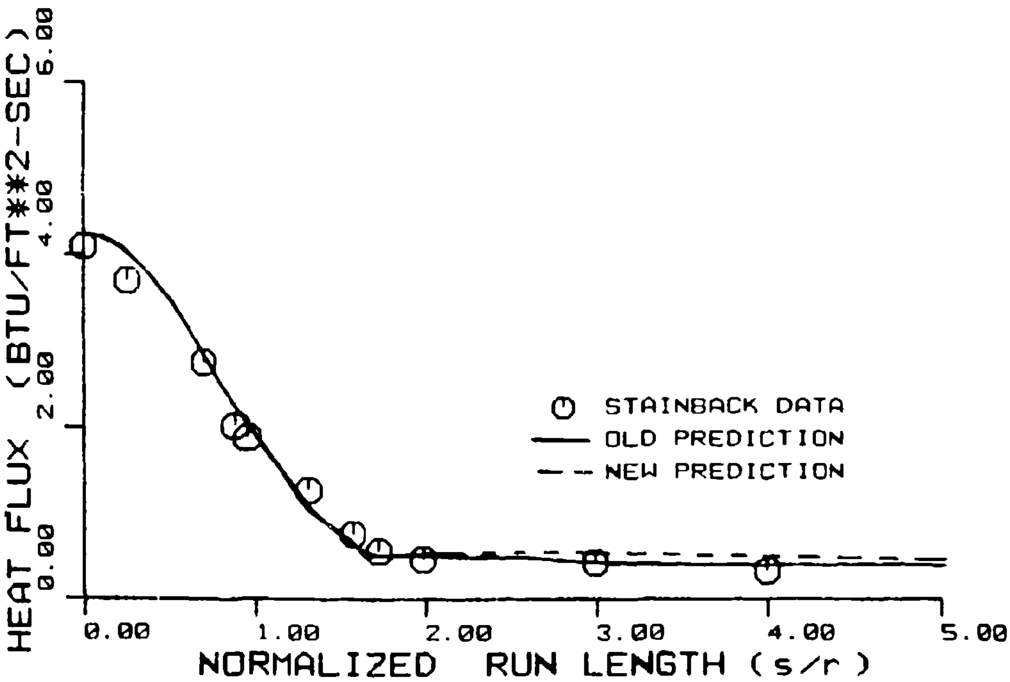


Figure 2-3. Heat transfer predictions of the experimental data of Stainback[5]
R_i = 0.25 inch, P_o = 223 psig, T_o = 441°F

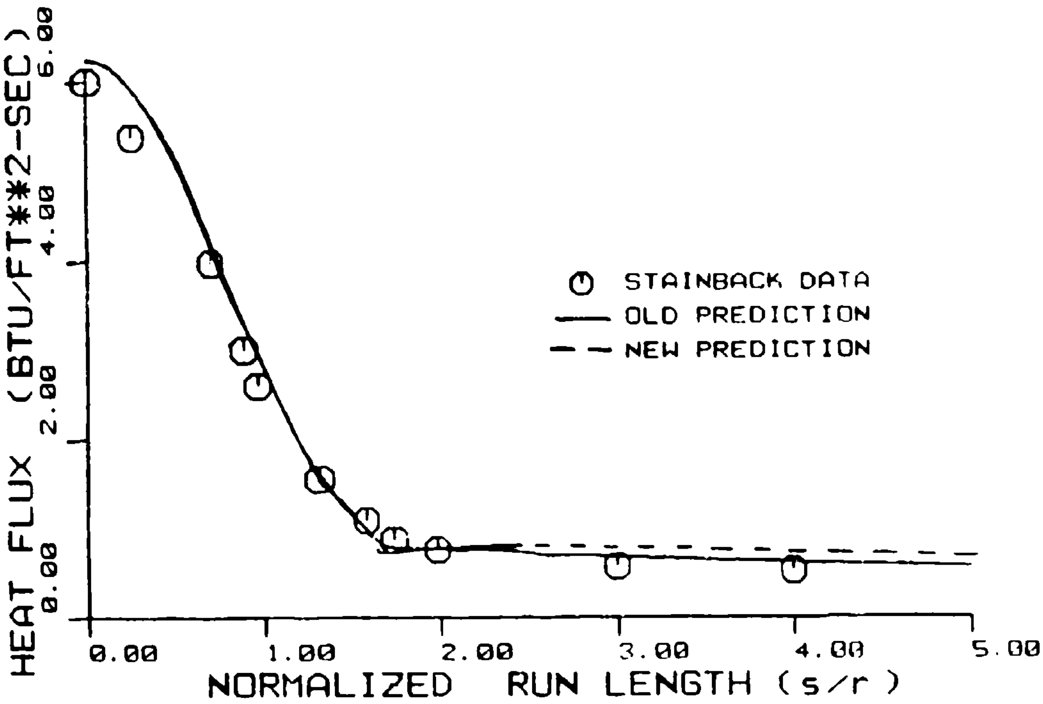


Figure 2-4. Heat transfer predictions of the experimental data of Stainback[5]
R_i = 0.25 inch, P_o = 109 psig, T_o = 432°F

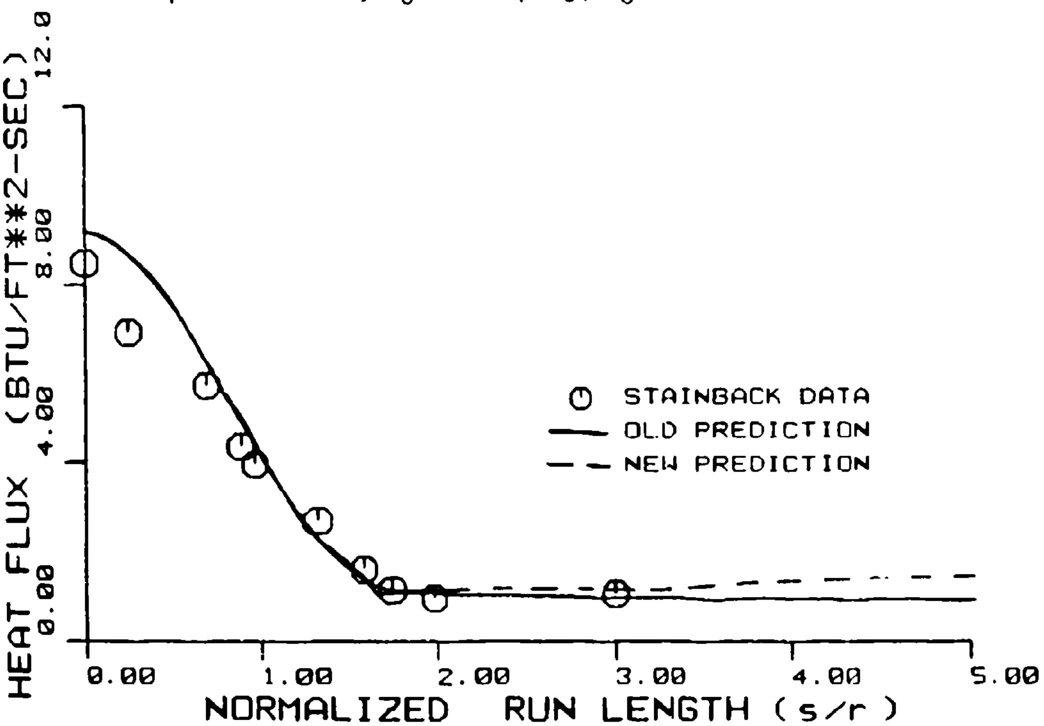


Figure 2-5. Heat transfer predictions of the experimental data of Stainback[5]
R_i = 0.25 inch, P_o = 65 psig, T_o = 437°F

wing. Also, the pressure ratio (P/P_0), is obtained from the axisymmetric ASCC80 correlation.

The results of Figures 2-2 through 2-5 indicate that PLNRASCC and Suchsland's version of ASCC produce very similar results for these cases. There are two reasons for this. First, the normal component of Mach number to the wing leading edge is relatively low, (2.47). This means that the influence of the shock shape on the boundary layer will also be small. For higher Mach numbers, the shock shape will have a more significant effect on entropy swallowing in the boundary layer. The second reason for the similarity in predictions is that, for zero wedge angle, the pressure predictions for the axisymmetric and two-dimensional correlations will be similar. This is not necessarily the case for higher wedge angles.

Figures 2-6 through 2-9 show predicted and experimental results for the data of Murray and Stallings.[6] Their experiment tested both 60° and 70° swept wings in a wind tunnel with a range of freestream Mach numbers and tunnel stagnation pressures. The aft wedge angle was zero for all of these cases. A boundary layer trip was used at S = 0.637 cm from the wing leading edge in order to provide for turbulent flow over the wing.

For the 70° swept wings tested by Murray and Stallings, the normal component of Mach number to the wing leading edge is too low (<1.75) to be covered by the pressure and shock shape correlations described in Section 2.1 of this report. Therefore, predicted results are only presented for cases with a 60° sweep angle. These predictions were made with PLNRASCC. The calculation was done with specified transition to turbulent flow at the boundary layer trip. Transitional heating was modeled in this calculation by specifying NREYCR = +4 in Input Table 1 of the input data.

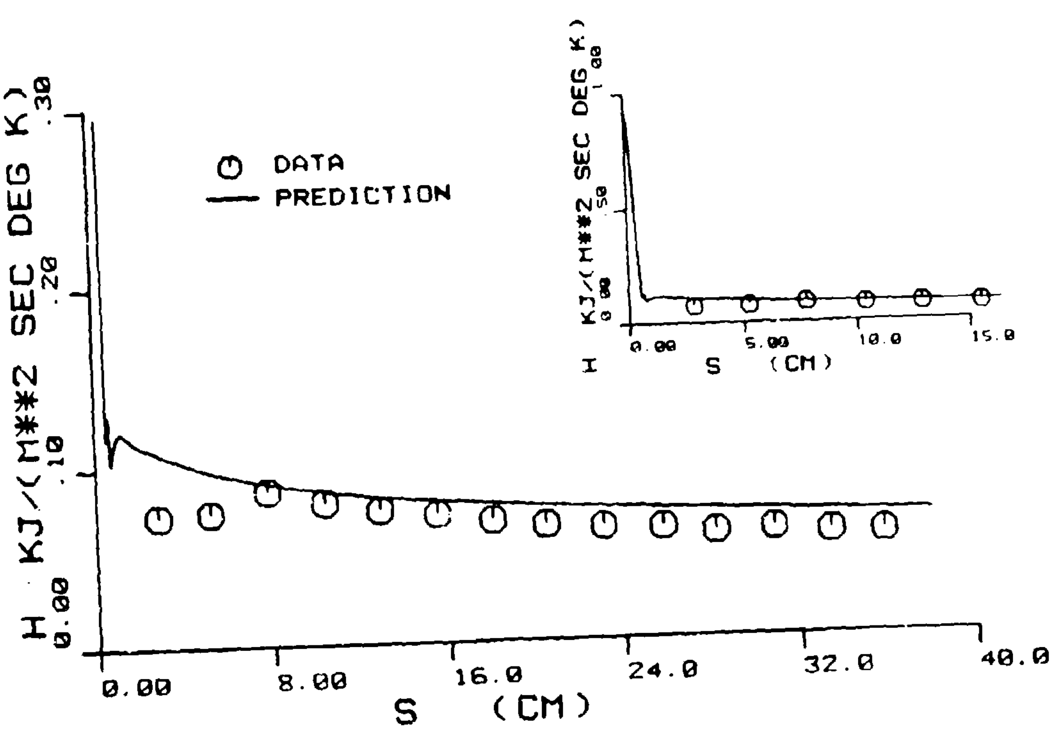


Figure 2-6. Heat transfer predictions of the experimental data of Murray and Stalling[6] R_i = 0.125 inch, M_∞ = 3.71, Re = 9.85 x 10^6 per meter, Λ = 60°

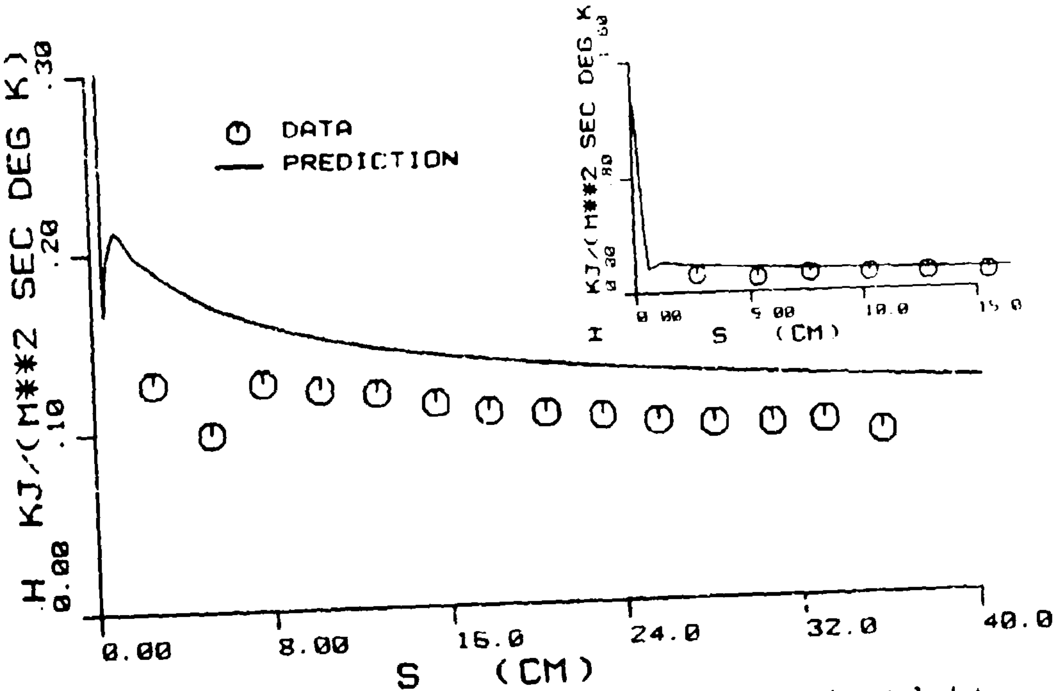


Figure 2-7. Heat transfer predictions of the experimental data of Murray and Stallings[6] R_i = 0.125 inch, M_∞ = 3.71, Re = 19.7 x 10^6 per meter, Λ = 60°

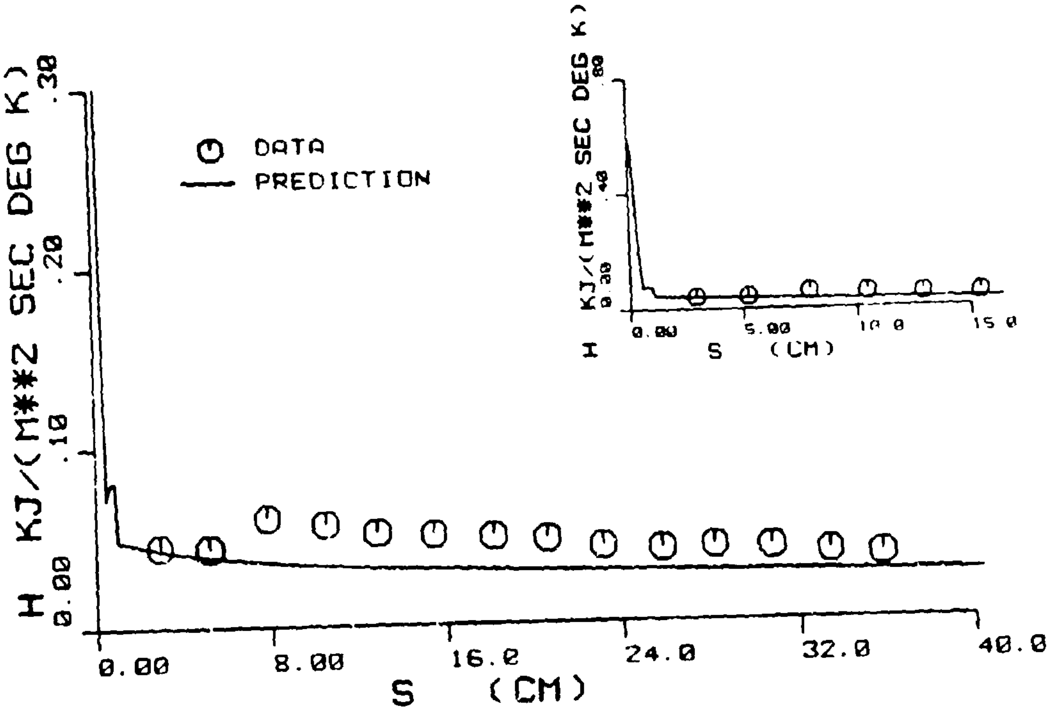


Figure 2-8. Heat transfer predictions of the experimental data of Murray and Stallings[6] R_i = 0.125 inch, M_∞ = 4.44, Re = 9.85 x 10^6 per meter, Λ = 60°

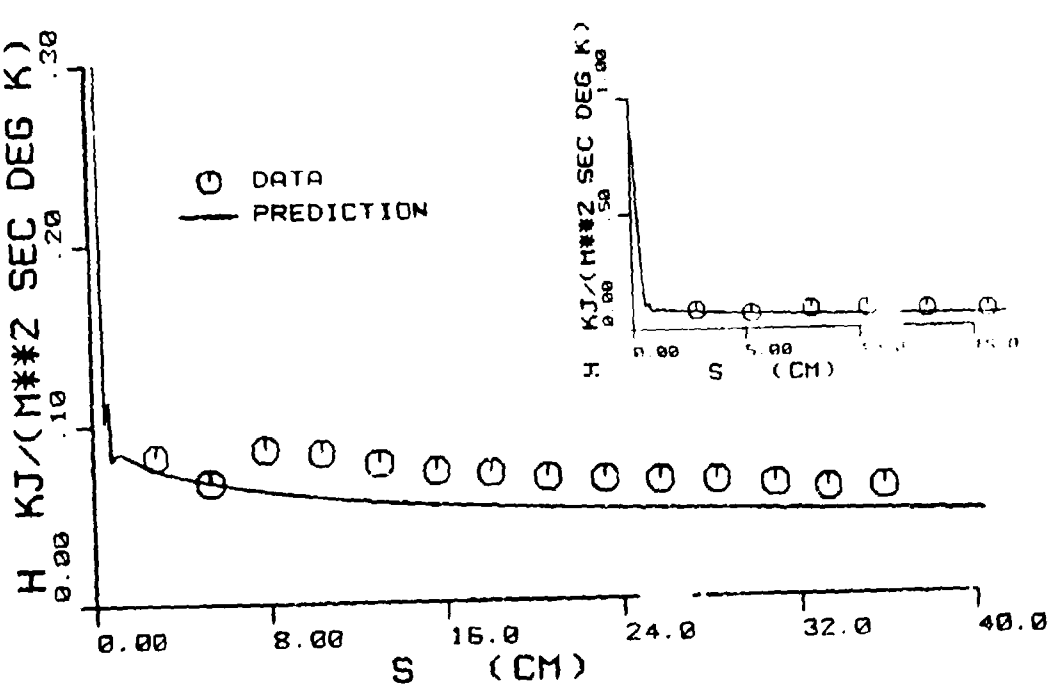


Figure 2-9. Heat transfer predictions of the experimental data of Murray and Stallings[6] R_i = 0.125 inch, M_∞ = 4.44, Re = 19.7 x 10^6 per meter, Λ = 60°

Predicted results cannot be expected to agree with the data near the boundary layer trip because the boundary layer requires a finite length after the trip until it becomes fully turbulent. This boundary layer recovery distance is clearly seen in the experimental data of Figures 2-6 through 2-9. The computer model, on the other hand, can change abruptly from laminar to turbulent flow.

Agreement between the PLNRASCC prediction and the $M_\infty = 3.71$ experimental data in Figures 2-6 and 2-7 is similar to what is found by Murray and Stallings.[6] They present predicted results that were obtained from the "strip theory" method of Van Driest.[7] For the higher Mach number cases in Figures 2-7 and 2-8, PLNRASCC underpredicts the heat transfer on the aft portion of the wing.

Murray and Stallings[6] estimate the uncertainty in their measured heat transfer coefficients to be 10 percent for $h > 306$ J/m^2-K, 15 percent for 20 J/m^2-s-K $< h <$ 306 J/m^2-s-K, and 20 percent for $h <$ 20 J/m^2-s-K. The predicted heat transfer results from PLNRASCC are close to being within these uncertainty ranges. Changes introduced to the experimental boundary layer by the presence of the trip may account for the remainder of the discrepancies. It should be noted that in all cases, the basic shapes of the PLNRASCC heat transfer predictions show good agreement with the experimental data.

A final comparison between PLNRASCC and experimental data is shown in Figures 2-10 through 2-12. These experiments were conducted by Hunt et al.[8] They used temperature-sensitive paint on a 60° swept wing in order to measure the heat transfer rates. High uncertainties are usually associated with this phase change paint technique, although no specific values are provided by Hunt et al.[8] The aft wedge angle was zero for all of their experiments. These

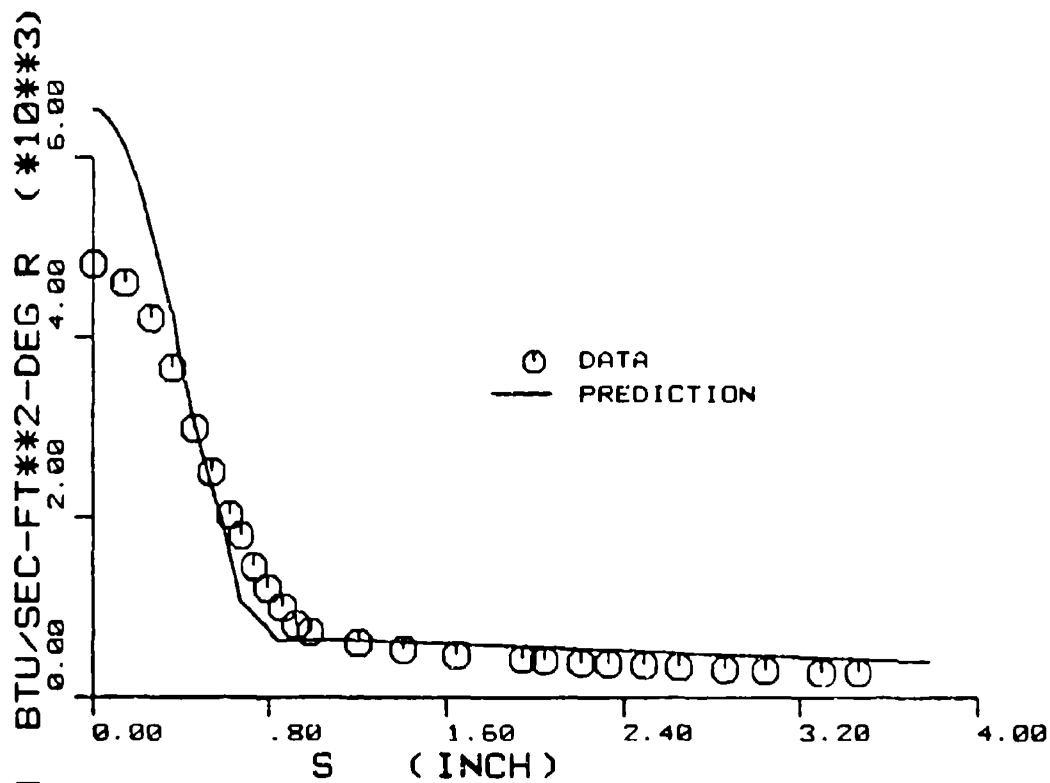


Figure 2-10. Heat transfer predictions of the experimental data of Hunt et al.[8] R_i = 0.5 inch, M_∞ = 7.81, Re = 0.92 x 10^5 (based on leading edge diameter), Λ = 60°

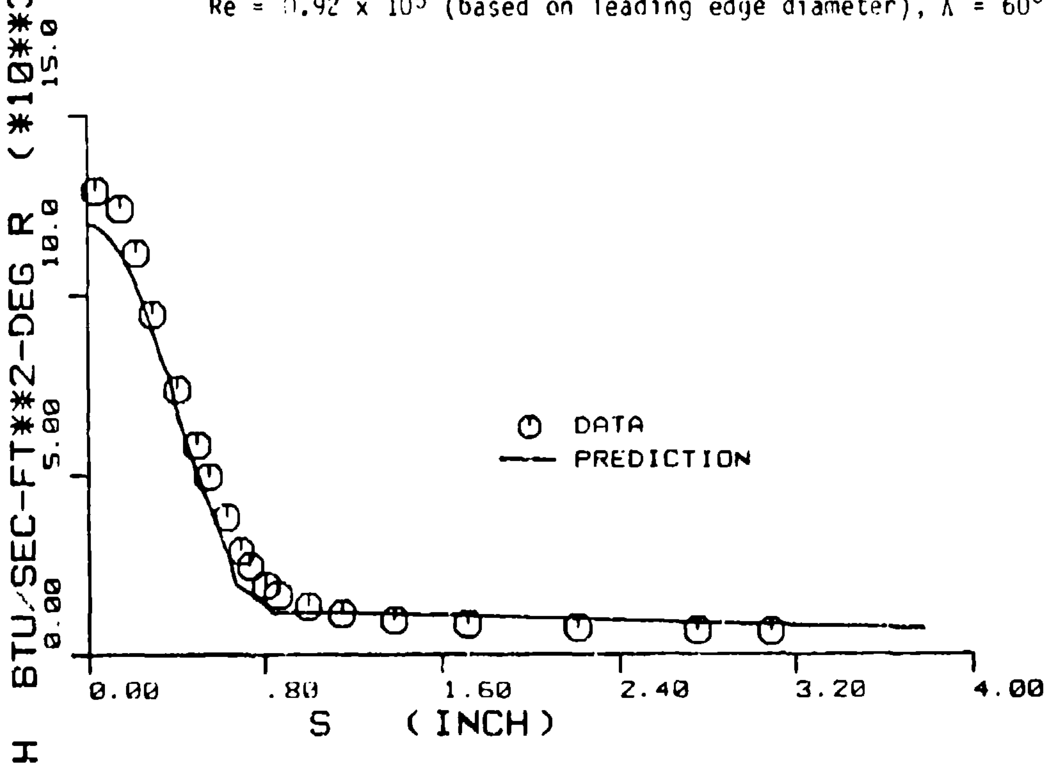


Figure 2-11. Heat transfer predictions of the experimental data of Hunt et al.[8] R_i = 0.5 inch, M_∞ = 7.94, Re = 2.6 x 10^5 (based on leading edge diameter), Λ = 60°

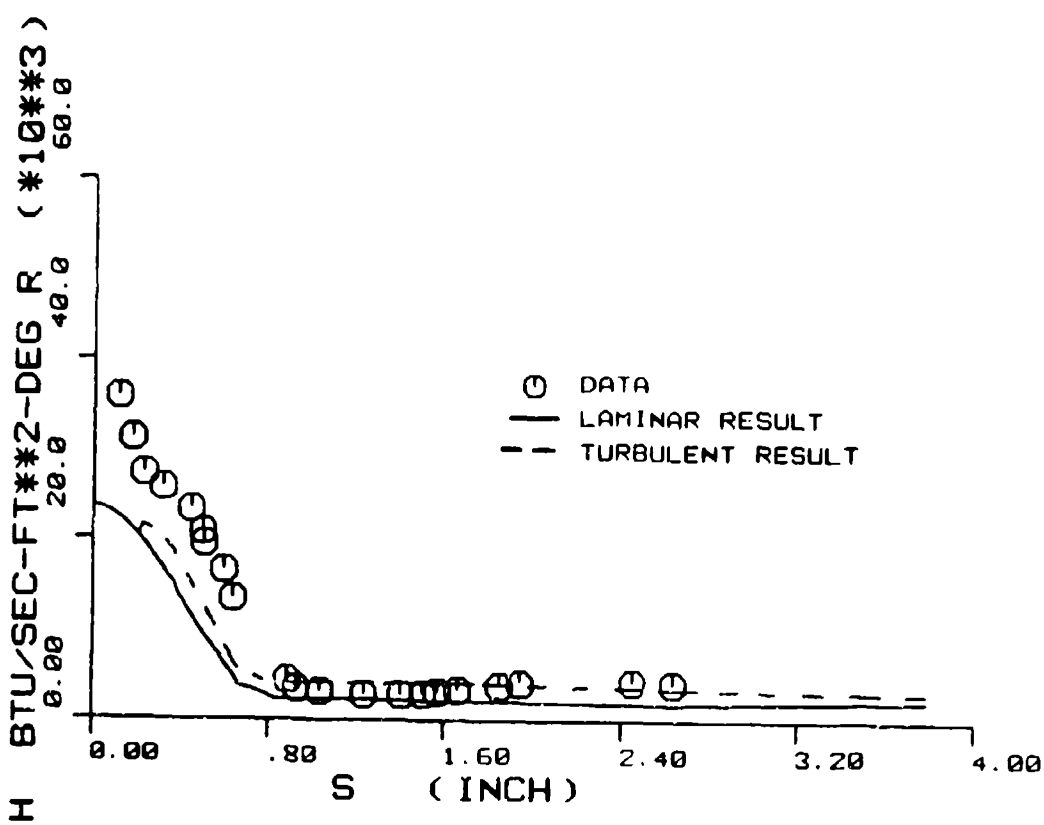


Figure 2-12. Heat transfer predictions of the experimental data of Hunt et al.[8] R_i = 0.5 inch, M_∞ = 7.98, Re = 9.3 x 10^5 (based on leading edge diameter), Λ = 60°

experiments had freestream Mach numbers close to 8.0 and a range of Reynolds numbers.

Results from the low Reynolds number case in Figure 2-10 are in fairly good agreement with the experimental data. The largest discrepancies occur near the leading edge of the wing. Laminar flow was observed experimentally over the entire wing, and the PLNRASCC result represents a laminar boundary layer calculation.

Figure 2-11 gives heat transfer results for a higher Reynolds number case. Again, the PLNRASCC prediction is in fairly good agreement with the data. Laminar flow was observed experimentally over the full length of the

wing, so a laminar boundary layer calculation was performed with the PLNRASC code.

Heat transfer results for the highest Reynolds number case of Hunt et al.[8] are shown in Figure 2-12. Turbulent flow was observed on the surface of the wing, but it is difficult to determine exactly where boundary layer transition takes place. Hunt et al.[8] concluded from their data that the flow was turbulent on the cylindrical nose of the wing. It apparently laminarized as it expanded around the nose and onto the flat plate. This laminarized boundary layer then went through a transition to turbulent flow at approximately S = 1.2 inches on the flat plate portion of the wing.

The PLNRASC code has no mechanism for modeling this sort of a laminarizing boundary layer. An attempt was made, however, to test the PLNRASC code against this experimental data. Two separate computer predictions were made. The first was a fully laminar calculation. The second prediction used a fixed transition location at S = 0.2 inch from the leading edge of the wing. Figure 2-12 indicates that the turbulent prediction shows better agreement with the experimental data, particularly in the region away from the nose of the wing. Neither prediction does well at the leading edge of the wing.

It should be noted that a fully turbulent PLNRASCC calculation was also attempted for this case. Abrupt transition to turbulence was specified immediately after the laminar series solution that starts off the calculation. This caused the boundary layer properties influence coefficient on Stanton number to change abruptly. The effect of this coefficient is very important at the leading edge of the wing. The result was that the turbulent heat transfer rate dropped below the corresponding laminar heat transfer rate for the first few integration points. This was clearly an unrealistic result, so

the transition location was moved farther back on the nose until this problem was no longer encountered.

Hunt et al.[8] also described a calculation method that they used to predict the heat transfer rates in their experiments. This finite difference calculation method included a spanwise momentum equation for predicting swept wing cases with large crossflows. The PLNRASCC heat transfer predictions in Figures 2-10 and 2-11 agree quite well with the predictions that Hunt et al. present in their paper. For the highest Reynolds number case shown in Figure 2-12, the laminar PLNRASCC prediction is in good agreement with a laminar prediction that is given in the Hunt et al.[8] paper.

2.1.2 Discussion and Conclusions on Flowfield Modifications

For laminar flow at relatively low supersonic Mach numbers, PLNRASCC does an adequate job of predicting heat transfer on swept wings. This is evidenced in the results of Suchsland[2] and also in the results presented in Figures 2-2 through 2-5 of this report. The limitations of this method for laminar flow are guided by the basic assumptions that were used in the formulation of the swept wing integral equations of Suchsland.[2]

The PLNRASC code has been demonstrated to be capable of predicting turbulent boundary layer heat transfer over swept wings in supersonic flow. The predicted results shown in Figures 2-6 through 2-12 appear to be quite reasonable considering the uncertainties associated with the experimental data.

One area that needs to be investigated further is the modeling of boundary layer transition on swept wings. Transition criteria based on momentum thickness Reynolds number cannot be easily applied to PLNRASCC for swept wing cases with cross-flow. This is because PLNRASCC computes the flow in a two-dimensional direction that is normal to the leading edge of the wing.

Reynolds numbers are formed in the code by using a vector component of boundary layer edge velocity. Thus, the boundary layer momentum thickness Reynolds number that is calculated by PLNRASCC has a questionable physical interpretation regarding boundary layer transition. It is suggested that users of PLNRASCC supply a fixed transition location to the code that is obtained from a procedure that is appropriate to three-dimensional boundary layers.

2.2 PLANAR IN-DEPTH HEAT CONDUCTION MODIFICATIONS

All of the modifications made to BRLASCC have been incorporated into PLNRASCC, and the documentation for these changes can be found in Volume I of this report. However, BRLASCC is an axisymmetric shape change code; hence, the heat conduction equation formulations used in PLNRASCC must be modified to correctly model the planar nature of the problems of interest.

2.2.1 Implicit Grid Modifications

The conduction equation in the moving orthogonal coordinate system (implicit grid) under the axisymmetric assumption ($\partial/\partial r = 0$) is:

$$\rho C_p \frac{\partial T}{\partial t} = \frac{1}{r_b\,(1 + r/r_c)} \left\{ \frac{\partial}{\partial s} \left[\left(\frac{r_b}{1 + r/r_c} \right) \kappa \frac{\partial T}{\partial s} \right] + \frac{\partial}{\partial r} \left[r_b (1 + r/r_c)\, \kappa \frac{\partial T}{\partial r} \right] \right\} + \rho C_p\, \dot{n}\, \frac{\partial T}{\partial r} \qquad (1)$$

where

C_p = specific heat

r_o = body circumferential radius of curvature

r_b = $r_o + r \cdot \cos(\theta)$

r_c = local streamwise radius of curvature

κ = thermal conductivity

ρ = density

$\dot{n}$ = surface normal recession rate, n = -r

T = temperature

t = time

θ = angle between normal to local surface and axis of symmetry

s = streamwise distance along body

r = distance normal to body surface at s, measured from surface

Under the planar assumption, the conduction equation takes the form:

$$\rho C_p \frac{\partial T}{\partial t} = \frac{1}{(1 + r/r_c)} \left\{ \frac{\partial}{\partial s} \left[\left(\frac{1}{1 + r/r_c} \right) \kappa \frac{\partial T}{\partial s} \right] + \frac{\partial}{\partial r} \left[(1 + r/r_c) \kappa \frac{\partial T}{\partial r} \right] \right\} + \rho C_p \dot{n} \frac{\partial T}{\partial r} \qquad (2)$$

The finite-difference equations in PLNRASCC have been modified to reflect the change in the differential equation, setting r_b to unity wherever the body radius of curvature appears.

2.2.2 Explicit Grid Modifications

Making use of the axisymmetric nature of the problems of interest the conduction equation in BRLASCC utilizes a fixed cylindrical coordinate system (explicit grid) and is given by:

$$\rho C_p \frac{\partial T}{\partial t} = \frac{\partial}{\partial x} \left(\kappa \frac{\partial T}{\partial x} \right) + \frac{1}{y} \frac{\partial}{\partial y} \left(y\kappa \frac{\partial T}{\partial y} \right) \qquad (3)$$

PLNRASCC however is not axisymmetric, and the conduction equation takes the form of the two-dimensional Cartesian coordinate heat conduction equation and is given by:

$$\rho C_p \frac{\partial T}{\partial t} = \frac{\partial}{\partial x} \left(\kappa \frac{\partial T}{\partial x} \right) + \frac{\partial}{\partial y} \left(\kappa \frac{\partial T}{\partial y} \right) \tag{4}$$

The finite-difference equations in PLNRASCC have been modified to reflect the change in the differential equation.

2.2.3 Validation of Planar Conduction Modifications

Analytical solutions presented in graphical form are available from Heisler[9] for the transient temperature distribution of multidimensional systems.[10] The solution for the transient temperature distribution of an infinite copper rectangle 4 inch x 8 inch was used to check the planar conduction modifications made in PLNRASCC. Figure 2-13 illustrates the problem.

The rectangle is at a uniform initial temperature of 530°R. The surface temperature is suddenly raised to 800°R. The temperature versus time at Point A was calculated using the Heisler charts and compared with PLNRASCC. The results are shown in Figure 2-14. The agreement between PLNRASCC and the Heisler chart solution is excellent. Only at 5 s does the solution from PLNRASCC depart significantly from the Heisler chart solution. This is due to the fact that the Fourier modulus at 5 s is less than 0.2, where the Heisler charts become invalid.

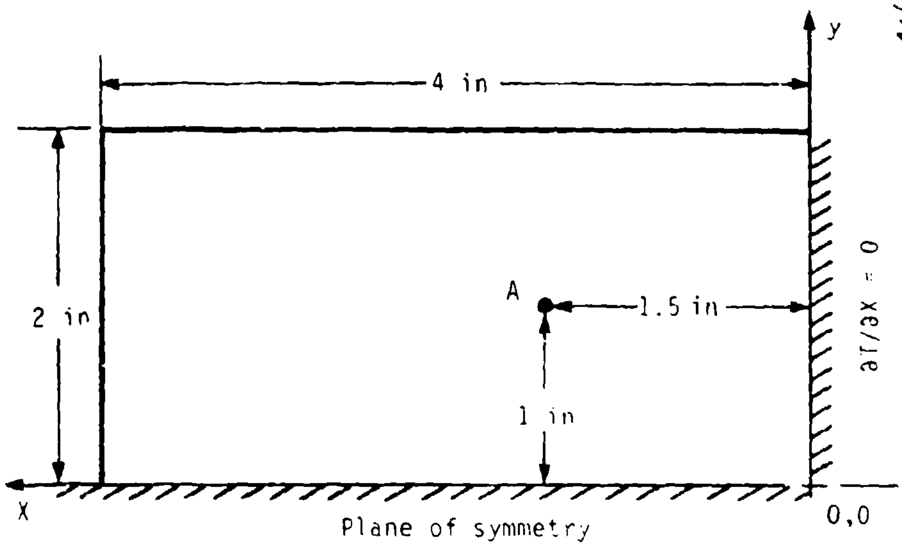


Figure 2-13. Infinite rectangle configuration

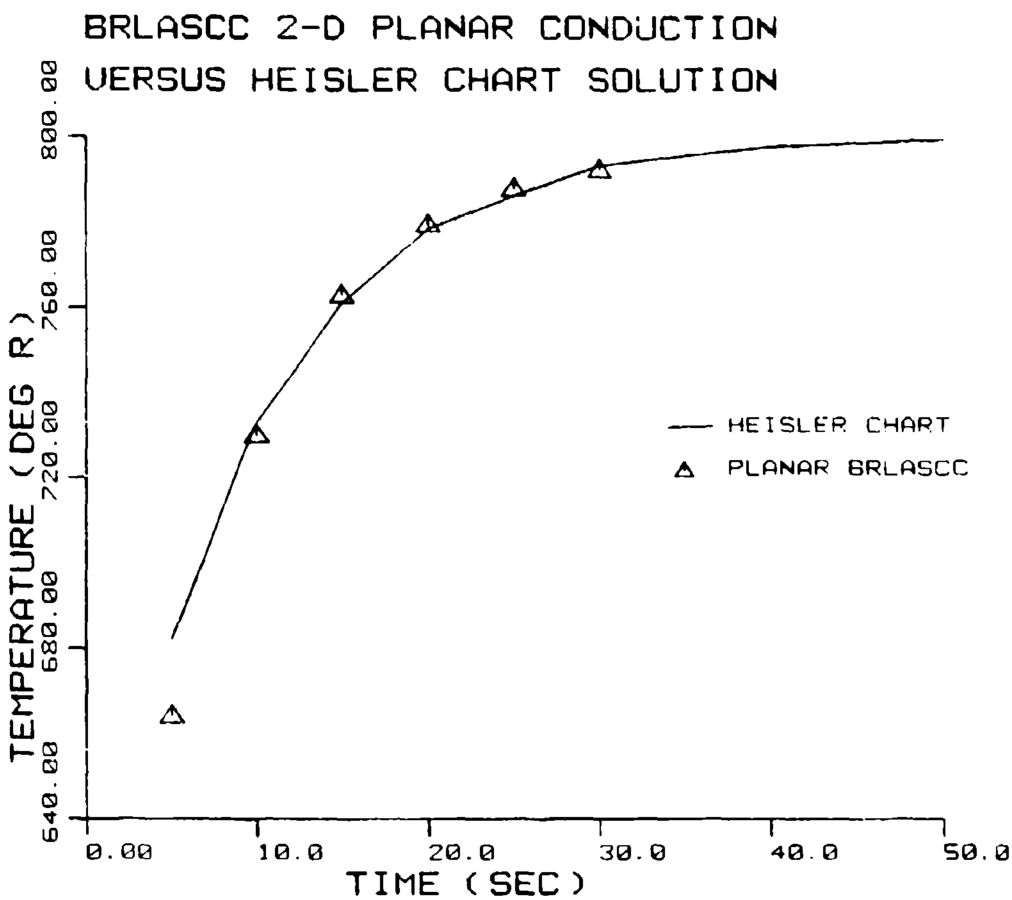


Figure 2-14. Comparison between PLNRASCC conduction solution and Heisler chart solution for an infinite rectangle

SECTION 3

INPUT AND OUTPUT

3.1 INPUT MODIFICATIONS TO THE BRLASCC COMPUTER CODE

Two of the input tables to the BRLASC code require modification in order to run the planar version of the code for swept wings. The conventional forms of these tables are described in Volume I of this report. The modifications that are described below should be implemented in conjunction with this reference.

TABLE 7: Surface Data

The modification to this table consists of an additional surface table that describes the geometry of the swept wing and also the specified option for computing the inviscid flowfield. Whenever a swept wing configuration is to be computed, the following subtable must be included in the surface data. This subtable takes the following form:

Card No.	Columns	Format	Data	Units
k	1 - 5	I5	Enter 4 (Swept wing configuration subtable)	--
	6 - 10	I5	Option for pressure calculation = 1 : Use 2-D cylinder/wedge correlations ≠ 1 : Do not use 2-D cylinder/wedge correlations	--
k+1	1 - 10	F10.5	Sweep angle of the wing measured from a normal to the flow direction	degree

	11 - 20	F10.5	Aft wedge angle	degree
k+2	1 - 5	I5	Enter -1 if other surface tables follow; +1 for last surface table	--

Note that if the 2-D cylinder/wedge correlations for pressure are not desired, the user has a number of options for specifying pressure that are described in Volume I of this report. These include two ways of specifying tabular values for pressure as well as using the axisymmetric pressure correlations that are built into BRLASCC and ASCC80.

TABLE 8: Shock Shape Data

This table gives the user the option of whether or not to use the 2-D shock shape correlations for swept wing configurations. The modification for input to this table is the addition of another shock shape flag. This modification is described below.

Card No.	Columns	Format	Data	Units
1	1 - 2	I2	Enter 08 (table number)	--
2	1 - 5	I5	ISHFLG -- shock shape flag 1- Shock angle given as function of y coordinate 2- Shock angle given as function of dimensionless y coordinate (y/R), where R is the nose radius. 3- Flag to use the 2-D planar shock shape correlations	--

The remainder of this table is identical to the one in Volume I of this report. Note that if TABLE 8 is not specified in the program input data, the code will use a shock shape that is generated from the axisymmetric correlations that are built in to BRLASCC and ASCC80.

SAMPLE PROBLEM 1

Swept Wing Configuration

Boundary Layer Solution

3.2 SAMPLE PROBLEM

This subsection illustrates two sample cases for the PLNRASC code. The first sample case is a prediction of a swept wing experiment from Stainback.[5] Heat transfer results from this case are presented in Figure 2-1.

The complete input data for this case is presented followed by selected portions of the output file. The user should note that the boundary layer calculation proceeds in a direction that is normal to the leading edge of the wing. Output quantities such as boundary layer edge velocity represent vector components of the total flowfield quantities.

The second sample problem is a planar calculation of the sample problem found in Volume I of this report. The axisymmetric projectile of Volume I has been made into a planar 60° swept wing. A complete listing of the input data is presented as well as selected output data.

PLNRASCC Sample Problem 1 Input Data

```
                         BRL/ASCC TWO-DIMENSIONAL TEST CASE
                                PLANAR SWEPT WING                        8/10/83

01
   0.0        0.0
    2    2    2    2    0    1            0
   1.0           2.0
01 1.0           4.0
02
   0.0           65.00     437.0        4.95
   1.0           109.0     432.0
   2.0           223.0     441.0
02 3.0           428.0     460.0
03
   50   20    1
    0.25         2.0       .0010          -1.00       550.
04
    4.0        470.0
    4.5        503.0
    5.0        537.0
04  5.5        575.0
07
    4    1
   60.00       0.0
    1
08
    3
 -1
    -1
```

Sample Problem 1 Output

```
            PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

                                   *************
*********************************** I N P U T ***********************************
                                   *************

                          BRL/ASCC TWO-DIMENSIONAL TEST CASE
                                 PLANAR SWEPT WING
                                                                      8/10

                         -- GENERAL PROGRAM FLAGS --

               (ENVIRONMENT FLAG)                      LG =  2
               (SHAPE CHANGE FLAG)                    ISS =  2
               (OUTPUT PRINT FLAG)                  IPRNT =  2
               (TRANSITION CRITERIA FLAG)          NREYCR =  2
               (BODY ANGLE DEFN. FLAG)               IRON =  0
               (CARBON TRANS. CRIT. FLAG)           ICARB =  1
               (NOSE SHAPE MODIFICATION FLAG)        IMOD =  0

                      -- TIME INCREMENT INFORMATION --

     INITIAL TIME (SEC)     0.0000            FINAL TIME (SEC)     0.0000

      OUTPUT INTERVAL =  1.0000 SEC FROM  INITIAL TIME UNTIL    2.0000 SEC
      OUTPUT INTERVAL =  1.0000 SEC FROM    2.0000 SEC UNTIL FINAL TIME


                         BOUNDARY LAYER ONLY SOLUTION

     COMPUTATION TIME STEPS SET EQUAL TO SPECIFIED ENVIRONMENT TIME STEPS

                        -- WIND TUNNEL ENVIRONMENT --

                         FREESTREAM MACH NO  =  4.95

          TIME           TOTAL PRESSURE      TOTAL TEMPERATURE
         (SEC)               (PSIA)               (DEG F)
          0.000              65.00                437.00
          1.000             109.00                432.00
          2.000             273.00                441.00
          3.000             428.00                460.00
```

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

— INITIAL GEOMETRY —

CYLINDER-WEDGE OPTION - GENERATED SHAPE

INITIAL NOSE RADIUS = 0.2500 INCHES
WEDGE ANGLE = 0.0010 DEGREES

FLAT BACK OPTION

MAXIMUM •Z• = 2.0000 INCHES
ORIGIN OF RAYS (Z) = 2.0000 INCHES
ORIGIN OF RAYS (R) = 0.0000 INCHES

BODY POINT INDEX	SURFACE COORDINATES Z (INCH)	SURFACE COORDINATES R (INCH)	THETA (DEG)	MATERIAL INDEX	OUTER INTERFACE COORDINATES Z (INCH)	OUTER INTERFACE COORDINATES R (INCH)	MATERIAL INDEX	INNER INTERFACE COORDINATES Z (INCH)	INNER INTERFACE COORDINATES R (INCH)	MATERIAL INDEX
1	0.0000	0.0000	90.00	1	0.0000	0.0000	1	0.0000	0.0000	1
2	0.0009	0.0206	85.26	1	0.0009	0.0206	1	0.0009	0.0206	1
3	0.0034	0.0411	80.53	1	0.0034	0.0411	1	0.0034	0.0411	1
4	0.0076	0.0614	75.79	1	0.0076	0.0614	1	0.0076	0.0614	1
5	0.0135	0.0812	71.05	1	0.0135	0.0812	1	0.0135	0.0812	1
6	0.0211	0.1004	66.32	1	0.0211	0.1004	1	0.0211	0.1004	1
7	0.0301	0.1190	61.58	1	0.0301	0.1190	1	0.0301	0.1190	1
8	0.0407	0.1367	56.84	1	0.0407	0.1367	1	0.0407	0.1367	1
9	0.0527	0.1536	52.11	1	0.0527	0.1536	1	0.0527	0.1536	1
10	0.0661	0.1693	47.37	1	0.0661	0.1693	1	0.0661	0.1693	1
11	0.0807	0.1839	42.63	1	0.0807	0.1839	1	0.0807	0.1839	1
12	0.0964	0.1973	37.90	1	0.0964	0.1973	1	0.0964	0.1973	1
13	0.1133	0.2093	33.16	1	0.1133	0.2093	1	0.1133	0.2093	1
14	0.1310	0.2199	28.42	1	0.1310	0.2199	1	0.1310	0.2199	1
15	0.1496	0.2289	23.68	1	0.1496	0.2289	1	0.1496	0.2289	1
16	0.1688	0.2365	18.95	1	0.1688	0.2365	1	0.1688	0.2365	1
17	0.1886	0.2423	14.21	1	0.1886	0.2423	1	0.1886	0.2423	1
18	0.2088	0.2466	9.47	1	0.2088	0.2466	1	0.2088	0.2466	1
19	0.2294	0.2491	4.74	1	0.2294	0.2491	1	0.2294	0.2491	1
20	0.2500	0.2500	1.19	1	0.2500	0.2500	1	0.2500	0.2500	1
21	0.2707	0.2500	0.00	1	0.2707	0.2500	1	0.2707	0.2500	1
22	0.2939	0.2500	0.00	1	0.2939	0.2500	1	0.2939	0.2500	1
23	0.3198	0.2500	0.00	1	0.3198	0.2500	1	0.3198	0.2500	1
24	0.3483	0.2500	0.00	1	0.3483	0.2500	1	0.3483	0.2500	1
25	0.3793	0.2500	0.00	1	0.3793	0.2500	1	0.3793	0.2500	1
26	0.4130	0.2500	0.00	1	0.4130	0.2500	1	0.4130	0.2500	1
27	0.4492	0.2500	0.00	1	0.4492	0.2500	1	0.4492	0.2500	1
28	0.4881	0.2500	0.00	1	0.4881	0.2500	1	0.4881	0.2500	1
29	0.5295	0.2500	0.00	1	0.5295	0.2500	1	0.5295	0.2500	1
30	0.5736	0.2500	0.00	1	0.5736	0.2500	1	0.5736	0.2500	1
31	0.6202	0.2500	0.00	1	0.6202	0.2500	1	0.6202	0.2500	1
32	0.6695	0.2500	0.00	1	0.6695	0.2500	1	0.6695	0.2500	1
33	0.7213	0.2500	0.00	1	0.7213	0.2500	1	0.7213	0.2500	1
34	0.7757	0.2500	0.00	1	0.7757	0.2500	1	0.7757	0.2500	1

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

35	0.8328	0.2500	0.00	1	0.8328	0.2500	1	0.8328	0.2500	1
36	0.8924	0.2500	0.00	1	0.8924	0.2500	1	0.8924	0.2500	1
37	0.9546	0.2500	0.00	1	0.9546	0.2500	1	0.9546	0.2500	1
38	1.0195	0.2500	0.00	1	1.0195	0.2500	1	1.0195	0.2500	1
39	1.0869	0.2500	0.00	1	1.0869	0.2500	1	1.0869	0.2500	1
40	1.1569	0.2500	0.00	1	1.1569	0.2500	1	1.1569	0.2500	1
41	1.2295	0.2500	0.00	1	1.2295	0.2500	1	1.2295	0.2500	1
42	1.3047	0.2500	0.00	1	1.3047	0.2500	1	1.3047	0.2500	1
43	1.3826	0.2500	0.00	1	1.3826	0.2500	1	1.3826	0.2500	1
44	1.4630	0.2500	0.00	1	1.4630	0.2500	1	1.4630	0.2500	1
45	1.5460	0.2500	0.00	1	1.5460	0.2500	1	1.5460	0.2500	1
46	1.6316	0.2500	0.00	1	1.6316	0.2500	1	1.6316	0.2500	1
47	1.7198	0.2500	0.00	1	1.7198	0.2500	1	1.7198	0.2500	1
48	1.8106	0.2500	0.00	1	1.8106	0.2500	1	1.8106	0.2500	1
49	1.9040	0.2500	0.00	1	1.9040	0.2500	1	1.9040	0.2500	1
50	2.0000	0.2500	0.00	1	2.0000	0.2500	1	2.0000	0.2500	1

INITIAL VALUE OF SURFACE TEMPERATURE = 550 00 DEG R

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

BODY SHAPE AND INVISCID FLOW INFORMATION

BODY PT NO (J)	INTEG PT NO (I)	STREAM LENGTH INCH (S)	AXIAL LENGTH INCH (Z)	TRANSVERSE LENGTH INCH (Y)	BODY ANGLE DEG (THETB)	PRESSURE RATIO (PEPI)	SHOCK PT NO (L)	SHOCK AXIAL LENGTH INCH (XSHC)	SHOCK RADIAL LENGTH INCH (YSHC)	SHOCK ANGLE DEG (BETA)	ENTROPY BEHIND SHOCK BTU/LBM-DEG R (SRB)
1	1	0.0000	0.0000	0.0000	90.00	1.000000	1	0.0000	0.0000	90.00	1.71512
	2	0.0034	0.0001	0.0034	89.21	0.999795	2	0.0000	0.0250	88.83	1.71509
	3	0.0069	0.0003	0.0069	88.42	0.999206	3	0.0000	0.0500	87.14	1.71495
	4	0.0103	0.0004	0.0103	87.63	0.998236	4	0.0000	0.0750	85.50	1.71470
	5	0.0138	0.0006	0.0138	86.84	0.996886	5	0.0000	0.1000	83.91	1.71436
	6	0.0172	0.0007	0.0172	86.05	0.995156	6	0.0000	0.1250	82.38	1.71393
2	7	0.0207	0.0009	0.0206	85.26	0.993048	7	0.0000	0.1500	80.89	1.71342
	8	0.0310	0.0021	0.0309	82.89	0.984478	8	0.0000	0.1750	79.44	1.71285
3	9	0.0413	0.0034	0.0411	80.53	0.972600	9	0.0000	0.2000	78.05	1.71222
	10	0.0517	0.0055	0.0513	78.16	0.957515	10	0.0000	0.2250	76.69	1.71153
4	11	0.0620	0.0076	0.0614	75.79	0.939358	11	0.0000	0.2500	75.38	1.71080
	12	0.0723	0.0106	0.0713	73.42	0.918291	12	0.0000	0.2750	74.11	1.71004
5	13	0.0826	0.0135	0.0812	71.05	0.894504	13	0.0000	0.3000	72.89	1.70924
	14	0.0930	0.0173	0.0908	68.68	0.868210	14	0.0000	0.3250	71.70	1.70842
6	15	0.1033	0.0211	0.1004	66.32	0.839649	15	0.0000	0.3500	70.55	1.70758
	16	0.1136	0.0256	0.1097	63.95	0.809078	16	0.0000	0.3750	69.44	1.70673
7	17	0.1240	0.0301	0.1190	61.58	0.776775	17	0.0000	0.4000	68.36	1.70586
	18	0.1343	0.0354	0.1279	59.21	0.743036	18	0.0000	0.4250	67.32	1.70499
8	19	0.1446	0.0407	0.1367	56.84	0.708171	19	0.0000	0.4500	66.32	1.70412
	20	0.1550	0.0467	0.1451	54.47	0.672502	20	0.0000	0.4750	65.35	1.70325
9	21	0.1653	0.0527	0.1536	52.11	0.636354	21	0.0000	0.5000	64.41	1.70238
	22	0.1756	0.0594	0.1614	49.74	0.599966	22	0.0000	0.5250	63.50	1.70152
10	23	0.1860	0.0661	0.1693	47.37	0.562556	23	0.0000	0.5500	62.62	1.70067
	24	0.1963	0.0734	0.1766	45.00	0.528282	24	0.0000	0.5750	61.77	1.69983
11	25	0.2066	0.0807	0.1839	42.63	0.492766	25	0.0000	0.6000	60.96	1.69909
	26	0.2179	0.0886	0.1906	40.26	0.459068	26	0.0000	0.6250	60.17	1.69819
12	27	0.2273	0.0964	0.1973	37.90	0.427248	27	0.0000	0.6500	59.40	1.69739
	28	0.2376	0.1049	0.2033	35.53	0.397242	28	0.0000	0.6750	58.66	1.69661
13	29	0.2479	0.1133	0.2093	33.16	0.368862	29	0.0000	0.7000	57.95	1.69585
	30	0.2583	0.1221	0.2146	30.79	0.341802	30	0.0000	0.7250	57.27	1.69511
14	31	0.2686	0.1310	0.2199	28.42	0.315635	31	0.0000	0.7500	56.60	1.69438
	32	0.2789	0.1403	0.2244	26.05	0.289825	32	0.0000	0.7750	55.96	1.69368
15	33	0.2893	0.1496	0.2289	23.68	0.262078	33	0.0000	0.8000	55.34	1.69299
	34	0.2996	0.1592	0.2327	21.32	0.236366	34	0.0000	0.8250	54.75	1.69233
16	35	0.3099	0.1688	0.2365	18.95	0.212864	35	0.0000	0.8500	54.17	1.69169
	36	0.3203	0.1787	0.2394	16.58	0.191734	36	0.0000	0.8750	53.62	1.69106
17	37	0.3306	0.1886	0.2423	14.21	0.178713	37	0.0000	0.9000	53.08	1.69046
	38	0.3409	0.1987	0.2445	11.84	0.165592	38	0.0000	0.9250	52.57	1.68988
18	39	0.3513	0.2088	0.2466	9.47	0.152671	39	0.0000	0.9500	52.07	1.68931
	40	0.3616	0.2191	0.2479	7.11	0.139650	40	0.0000	0.9750	51.59	1.68877
19	41	0.3719	0.2294	0.2491	4.74	0.126629	41	0.0000	1.0000	51.13	1.68824
	42	0.3823	0.2397	0.2496	2.96	0.116864	42	0.0000	1.0250	50.68	1.68774
20	43	0.3926	0.2500	0.2500	1.19	0.107098	43	0.0000	1.0500	50.25	1.68725
	44	0.4029	0.2[illegible]	0.2500	0.59	0.103842	44	0.0000	1.0750	49.84	1.68678

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

BODY PT NO (J)	INTEG PT NO (I)	STREAM LENGTH INCH (S)	AXIAL LENGTH INCH (Z)	TRANSVERSE LENGTH INCH (Y)	BODY ANGLE DEG (THETB)	PRESSURE RATIO (PEPI)	SHOCK PT NO (L)	SHOCK AXIAL LENGTH INCH (XSHC)	SHOCK RADIAL LENGTH INCH (YSHC)	SHOCK ANGLE DEG (BETA)	ENTROPY BEHIND SHOCK BTU/LBM-DEG R (SRB)
21	45	0.4133	0.2707	0.2500	0.00	0.106137	45	0.0000	1.1000	49.44	1.68633
	46	0.4249	0.2823	0.2500	0.00	0.108617	46	0.0000	1.1250	49.05	1.68589
22	47	0.4365	0.2939	0.2500	0.00	0.110989	47	0.0000	1.1500	48.68	1.68548
	48	0.4494	0.3069	0.2500	0.00	0.113506	48	0.0000	1.1750	48.32	1.68507
23	49	0.4624	0.3198	0.2500	0.00	0.115898	49	0.0000	1.2000	47.97	1.68469
	50	0.4766	0.3340	0.2500	0.00	0.118394	50	0.0000	1.2250	47.64	1.68431
24	51	0.4908	0.3483	0.2500	0.00	0.120751	51	0.0000	1.2500	47.32	1.68396
	52	0.5064	0.3638	0.2500	0.00	0.123172	52	0.0000	1.2750	47.01	1.68361
25	53	0.5219	0.3793	0.2500	0.00	0.125441	53	0.0000	1.3000	46.71	1.68328
	54	0.5387	0.3961	0.2500	0.00	0.127737	54	0.0000	1.3250	46.42	1.68297
26	55	0.5556	0.4130	0.2500	0.00	0.129870	55	0.0000	1.3500	46.14	1.68266
	56	0.5737	0.4311	0.2500	0.00	0.131997	56	0.0000	1.3750	45.87	1.68237
27	57	0.5918	0.4492	0.2500	0.00	0.133955	57	0.0000	1.4000	45.62	1.68209
	58	0.6112	0.4686	0.2500	0.00	0.135876	58	0.0000	1.4250	45.37	1.68182
28	59	0.6307	0.4881	0.2500	0.00	0.137625	59	0.0000	1.4500	45.12	1.68156
	60	0.6514	0.5088	0.2500	0.00	0.139312	60	0.0000	1.4750	44.89	1.68131
29	61	0.6721	0.5295	0.2500	0.00	0.140827	61	0.0000	1.5000	44.67	1.68106
	62	0.6941	0.5515	0.2500	0.00	0.142262	62	0.0000	1.5250	44.45	1.68083
30	63	0.7162	0.5736	0.2500	0.00	0.143529	63	0.0000	1.5500	44.24	1.68061
	64	0.7395	0.5969	0.2500	0.00	0.144702	64	0.0000	1.5750	44.04	1.68040
31	65	0.7628	0.6202	0.2500	0.00	0.145715	65	0.0000	1.6000	43.84	1.68019
	66	0.7874	0.6448	0.2500	0.00	0.146626	66	0.0000	1.6250	43.65	1.67999
32	67	0.8120	0.6695	0.2500	0.00	0.147388	67	0.0000	1.6500	43.46	1.67980
	68	0.8380	0.6954	0.2500	0.00	0.148046	68	0.0000	1.6750	43.29	1.67962
33	69	0.8639	0.7213	0.2500	0.00	0.148570	69	0.0000	1.7000	43.11	1.67944
	70	0.8911	0.7485	0.2500	0.00	0.148993	70	0.0000	1.7250	42.95	1.67927
34	71	0.9183	0.7757	0.2500	0.00	0.149299	71	0.0000	1.7500	42.78	1.67910
	72	0.9468	0.8042	0.2500	0.00	0.149510	72	0.0000	1.7750	42.63	1.67894
35	73	0.9754	0.8328	0.2500	0.00	0.149624	73	0.0000	1.8000	42.47	1.67879
	74	1.0052	0.8626	0.2500	0.00	0.149655	74	0.0000	1.8250	42.33	1.67864
36	75	1.0350	0.8924	0.2500	0.00	0.149610	75	0.0000	1.8500	42.18	1.67850
	76	1.0661	0.9235	0.2500	0.00	0.149494	76	0.0000	1.8750	42.04	1.67836
37	77	1.0972	0.9546	0.2500	0.00	0.149323	77	0.0000	1.9000	41.91	1.67822
	78	1.1296	0.9870	0.2500	0.00	0.149098	78	0.0000	1.9250	41.77	1.67809
38	79	1.1620	1.0195	0.2500	0.00	0.148838	79	0.0000	1.9500	41.64	1.67796
	80	1.1958	1.0532	0.2500	0.00	0.148540	80	0.0000	1.9750	41.52	1.67784
39	81	1.2295	1.0869	0.2500	0.00	0.148225	81	0.0000	2.0000	41.40	1.67772
	82	1.2645	1.1219	0.2500	0.00	0.147889	82	0.0000	2.0250	41.28	1.67760
40	83	1.2995	1.1569	0.2500	0.00	0.147553	83	0.0000	2.0575	41.12	1.67746
	84	1.3358	1.1932	0.2500	0.00	0.147210	84	0.0000	2.0997	40.93	1.67727
41	85	1.3721	1.2295	0.2500	0.00	0.146880	85	0.0000	2.1547	40.70	1.67705
	86	1.4097	1.2671	0.2500	0.00	0.146557	86	0.0000	2.2261	40.40	1.67677
42	87	1.4473	1.3047	0.2500	0.00	0.146257	87	0.0000	2.3189	40.04	1.67644
	88	1.4862	1.3437	0.2500	0.00	0.145972	88	0.0000	2.4396	39.60	1.67604
43	89	1.5251	1.3826	0.2500	0.00	0.145717	89	0.0000	2.5964	39.07	1.67556
	90	1.5654	1.4228	0.2500	0.00	0.145483	90	0.0000	2.8004	38.43	1.67501
44	91	1.6056	1.4630	0.2500	0.00	0.145281	91	0.0000	3.0655	37.66	1.67437

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

BODY PT NO (J)	INTEG PT NO (I)	STREAM LENGTH INCH (S)	AXIAL LENGTH INCH (Z)	TRANSVERSE LENGTH INCH (Y)	BODY ANGLE DEG (THETB)	PRESSURE RATIO (PEPI)	SHOCK PT NO (L)	SHOCK AXIAL LENGTH INCH (XSHC)	SHOCK RADIAL LENGTH INCH (YSHC)	SHOCK ANGLE DEG (BETA)	ENTROPY BEHIND SHOCK BTU/LBM-DEG R (SRB)
	92	1.6471	1.5045	0.2500	0.00	0.145103	92	0.0000	3.4101	36.76	1.67366
45	93	1.6886	1.5460	0.2500	0.00	0.144955	93	0.0000	3.8582	35.79	1.67294
	94	1.7314	1.5888	0.2500	0.00	0.144830	94	0.0000	4.4406	34.86	1.67231
46	95	1.7742	1.6316	0.2500	0.00	0.144729	95	0.0000	5.1978	33.92	1.67173
	96	1.8183	1.6757	0.2500	0.00	0.144648	96	0.0000	6.1822	32.94	1.67118
47	97	1.8624	1.7198	0.2500	0.00	0.144584	97	0.0000	7.4618	31.36	1.67044
	98	1.8927	1.7501	0.2500	0.00	0.144548	98	0.0000	9.1253	29.30	1.66974
	99	1.9229	1.7803	0.2500	0.00	0.144518	99	0.0000	11.2880	26.62	1.66928
48	100	1.9532	1.8106	0.2500	0.00	0.144490	100	0.0000	14.0993	25.12	1.66920
	101	1.9843	1.8417	0.2500	0.00	0.144464	101	0.0000	17.7541	25.12	1.66920
	102	2.0155	1.8729	0.2500	0.00	0.144440					
49	103	2.0466	1.9040	0.2500	0.00	0.144415					
	104	2.0786	1.9360	0.2500	0.00	0.144389					
	105	2.1106	1.9680	0.2500	0.00	0.144360					
50	106	2.1426	2.0000	0.2500	0.00	0.144328					

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

VISCOUS FLOW - WALL AND B. L. RECOVERY PROPERTIES

BODY PT NO (J)	INTEG PT NO (I)	STREAM LENGTH INCH (S)	WALL TEMPERATURE DEG R (TW)	WALL ENTHALPY BTU/LBM (HW)	WALL DENSITY LBM/FT3 (ROW)	WALL VISCOSITY LBM/FT-SEC (VISW)	RECOVERY ENTHALPY BTU/LBM (HR)	RECOVERY FACTOR (RECOV)	SENSBL CONV HEAT FLUX BTU/FT2-SEC	CF/2
1	1	0.0000	550.0	7.3	5.350E-03	1.260E-05	69.6	0.8367	3.320E+00	1.000E+30
	2	0.0034	550.0	7.3	5.348E-03	1.260E-05	69.6	0.8367	3.320E+00	7.104E-01
	3	0.0069	550.0	7.3	5.345E-03	1.260E-05	69.6	0.8367	3.319E+00	3.553E-01
	4	0.0103	550.0	7.3	5.340E-03	1.260E-05	69.6	0.8367	3.317E+00	2.374E-01
	5	0.0138	550.0	7.3	5.333E-03	1.260E-05	69.6	0.8367	3.315E+00	1.777E-01
	6	0.0172	550.0	7.3	5.324E-03	1.260E-05	69.6	0.8367	3.312E+00	1.421E-01
2	7	0.0207	550.0	7.3	5.312E-03	1.260E-05	69.6	0.8367	3.308E+00	1.184E-01
	8	0.0310	550.0	7.3	5.266E-03	1.260E-05	69.5	0.8367	3.285E+00	7.927E-02
3	9	0.0413	550.0	7.3	5.203E-03	1.260E-05	69.5	0.8367	3.252E+00	5.972E-02
	10	0.0517	550.0	7.3	5.122E-03	1.260E-05	69.4	0.8367	3.213E+00	4.802E-02
4	11	0.0620	550.0	7.3	5.025E-03	1.260E-05	69.4	0.8367	3.167E+00	4.025E-02
	12	0.0723	550.0	7.3	4.912E-03	1.260E-05	69.3	0.8367	3.114E+00	3.474E-02
5	13	0.0826	550.0	7.3	4.785E-03	1.260E-05	69.2	0.8367	3.053E+00	3.064E-02
	14	0.0930	550.0	7.3	4.645E-03	1.260E-05	69.1	0.8367	2.986E+00	2.748E-02
6	15	0.1033	550.0	7.3	4.492E-03	1.260E-05	68.9	0.8367	2.912E+00	2.497E-02
	16	0.1136	550.0	7.3	4.328E-03	1.260E-05	68.8	0.8367	2.832E+00	2.296E-02
7	17	0.1240	550.0	7.3	4.155E-03	1.260E-05	68.7	0.8367	2.747E+00	2.129E-02
	18	0.1343	550.0	7.3	3.975E-03	1.260E-05	68.5	0.8367	2.659E+00	1.993E-02
8	19	0.1446	550.0	7.3	3.788E-03	1.260E-05	68.3	0.8367	2.561E+00	1.872E-02
	20	0.1550	550.0	7.3	3.598E-03	1.260E-05	68.2	0.8367	2.461E+00	1.773E-02
9	21	0.1653	550.0	7.3	3.404E-03	1.260E-05	68.0	0.8367	2.358E+00	1.687E-02
	22	0.1756	550.0	7.3	3.210E-03	1.260E-05	67.8	0.8367	2.254E+00	1.618E-02
10	23	0.1860	550.0	7.3	3.009E-03	1.260E-05	67.6	0.8367	2.153E+00	1.564E-02
	24	0.1963	550.0	7.3	2.826E-03	1.260E-05	67.4	0.8367	2.027E+00	1.476E-02
11	25	0.2066	550.0	7.3	2.636E-03	1.260E-05	67.1	0.8367	1.932E+00	1.447E-02
	26	0.2170	550.0	7.3	2.456E-03	1.260E-05	66.9	0.8367	1.819E+00	1.392E-02
12	27	0.2273	550.0	7.3	2.286E-03	1.260E-05	66.7	0.8367	1.710E+00	1.341E-02
	28	0.2376	553.0	7.3	2.125E-03	1.260E-05	66.5	0.8367	1.607E+00	1.296E-02
13	29	0.2479	550.0	7.3	1.973E-03	1.260E-05	66.3	0.8367	1.509E+00	1.259E-02
	30	0.2583	550.0	7.3	1.828E-03	1.260E-05	66.1	0.8367	1.417E+00	1.233E-02
14	31	0.2686	550.0	7.3	1.688E-03	1.260E-05	65.8	0.8367	1.330E+00	1.219E-02
	32	0.2789	550.0	7.3	1.550E-03	1.260E-05	65.6	0.8367	1.248E+00	1.226E-02
15	33	0.2893	550.0	7.3	1.402E-03	1.260E-05	65.4	0.8367	1.173E+00	1.274E-02
	34	0.2996	550.0	7.3	1.264E-03	1.260E-05	65.1	0.8367	1.080E+00	1.275E-02
16	35	0.3099	550.0	7.3	1.139E-03	1.260E-05	64.8	0.8367	9.903E-01	1.267E-02
	36	0.3203	550.0	7.3	1.026E-03	1.260E-05	64.6	0.8367	9.065E-01	1.238E-02
17	37	0.3306	550.0	7.3	9.560E-04	1.260E-05	64.4	0.8367	8.059E-01	1.079E-02
	38	0.3409	550.0	7.3	8.864E-04	1.260E-05	64.2	0.8367	7.622E-01	1.072E-02
18	39	0.3513	550.0	7.3	8.167E-04	1.260E-05	64.1	0.8367	7.180E-01	1.078E-02
	40	0.3616	550.0	7.3	7.471E-04	1.260E-05	63.9	0.8367	6.736E-01	1.099E-02
19	41	0.3719	550.0	7.3	6.774E-04	1.260E-05	63.6	0.8367	6.284E-01	1.123E-02
	42	0.3823	550.0	7.3	6.252E-04	1.260E-05	63.5	0.8367	5.702E-01	1.057E-02
20	43	0.3926	550.0	7.3	5.729E-04	1.260E-05	63.3	0.8367	5.357E-01	1.058E-02
	44	0.4029	550.0	7.3	5.555E-04	1.260E-05	63.2	0.8367	4.548E-01	7.796E-03

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

BODY PT NO (J)	INTEG PT NO (I)	STREAM LENGTH INCH (S)	WALL TEMPERATURE DEG R (TW)	WALL ENTHALPY BTU/LBM (HW)	WALL DENSITY LBM/FT3 (ROW)	WALL VISCOSITY LBM/FT-SEC (VISW)	RECOVERY ENTHALPY BTU/LBM (HR)	RECOVERY FACTOR (RECOV)	SENSBL CONV HEAT FLUX BTU/FT2-SEC	CF/2
21	45	0.4133	550.0	7.3	5.678E-04	1.260E-05	63.3	0.8367	3.825E-01	[illegible]
	46	0.4249	550.0	7.3	5.810E-04	1.260E-05	63.3	0.8367	3.877E-01	[illegible]
22	47	0.4365	550.0	7.3	5.937E-04	1.260E-05	63.4	0.8367	3.926E-01	4.526E-03
	48	0.4494	550.0	7.3	6.072E-04	1.260E-05	63.4	0.8367	3.974E-01	4.204E-03
23	49	0.4624	550.0	7.3	6.200E-04	1.260E-05	63.5	0.8367	4.018E-01	3.935E-03
	50	0.4766	550.0	7.3	6.334E-04	1.260E-05	63.5	0.8367	4.061E-01	3.684E-03
24	51	0.4908	550.0	7.3	6.460E-04	1.260E-05	63.5	0.8367	4.098E-01	3.470E-03
	52	0.5064	550.0	7.3	6.589E-04	1.260E-05	63.6	0.8367	4.134E-01	3.270E-03
25	53	0.5219	550.0	7.3	6.710E-04	1.260E-05	63.6	0.8367	4.164E-01	3.098E-03
	54	0.5387	550.0	7.3	6.833E-04	1.260E-05	63.7	0.8367	4.191E-01	2.937E-03
26	55	0.5556	550.0	7.3	6.947E-04	1.260E-05	63.7	0.8367	4.213E-01	2.798E-03
	56	0.5737	550.0	7.3	7.061E-04	1.260E-05	63.7	0.8367	4.231E-01	2.667E-03
27	57	0.5918	550.0	7.3	7.166E-04	1.260E-05	63.8	0.8367	4.244E-01	2.552E-03
	58	0.6112	550.0	7.3	7.269E-04	1.260E-05	63.8	0.8367	4.253E-01	2.445E-03
28	59	0.6307	550.0	7.3	7.362E-04	1.260E-05	63.8	0.8367	4.257E-01	2.350E-03
	60	0.6514	550.0	7.3	7.453E-04	1.260E-05	63.9	0.8367	4.257E-01	2.262E-03
29	61	0.6721	550.0	7.3	7.534E-04	1.260E-05	63.9	0.8367	4.253E-01	2.184E-03
	62	0.6941	550.0	7.3	7.610E-04	1.260E-05	63.9	0.8367	4.244E-01	2.110E-03
30	63	0.7162	550.0	7.3	7.678E-04	1.260E-05	63.9	0.8367	4.231E-01	2.046E-03
	64	0.7395	550.0	7.3	7.741E-04	1.260E-05	63.9	0.8367	4.214E-01	1.985E-03
31	65	0.7628	550.0	7.3	7.795E-04	1.260E-05	64.0	0.8367	4.193E-01	1.931E-03
	66	0.7874	550.0	7.3	7.844E-04	1.260E-05	64.0	0.8367	4.169E-01	1.881E-03
32	67	6.8120	550.0	7.3	7.885E-04	1.260E-05	64.0	0.8367	4.142E-01	1.836E-03
	68	0.8380	550.0	7.3	7.920E-04	1.260E-05	64.0	0.8367	4.111E-01	1.794E-03
33	69	0.8639	550.0	7.3	7.948E-04	1.260E-05	64.0	0.8367	4.078E-01	1.756E-03
	70	0.8911	550.0	7.3	7.970E-04	1.260E-05	64.0	0.8367	4.042E-01	1.721E-03
34	71	0.9183	550.0	7.3	7.987E-04	1.260E-05	64.0	0.8367	4.005E-01	1.689E-03
	72	0.9468	550.0	7.3	7.998E-04	1.260E-05	64.0	0.8367	3.965E-01	1.660E-03
35	73	0.9754	550.0	7.3	8.004E-04	1.260E-05	64.0	0.8367	3.924E-01	1.633E-03
	74	1.0052	550.0	7.3	8.006E-04	1.260E-05	64.0	0.8367	3.881E-01	1.608E-03
36	75	1.0350	550.0	7.3	8.003E-04	1.260E-05	64.0	0.8367	3.848E-01	1.591E-03
	76	1.0661	550.0	7.3	7.997E-04	1.260E-05	64.0	0.8367	3.817E-01	1.578E-03
37	77	1.0972	550.0	7.3	7.988E-04	1.260E-05	64.0	0.8367	3.785E-01	1.565E-03
	78	1.1296	550.0	7.3	7.976E-04	1.260E-05	64.0	0.8367	3.749E-01	1.552E-03
38	79	1.1620	550.0	7.3	7.962E-04	1.260E-05	64.0	0.8367	3.711E-01	1.539E-03
	80	1.1958	550.0	7.3	7.946E-04	1.260E-05	64.0	0.8367	3.671E-01	1.525E-03
39	81	1.2295	550.0	7.3	7.929E-04	1.260E-05	64.0	0.8367	3.630E-01	1.510E-03
	82	1.2645	550.0	7.3	7.911E-04	1.260E-05	64.0	0.8367	3.587E-01	1.495E-03
40	83	1.2995	550.0	7.3	7.893E-04	1.260E-05	64.0	0.8367	3.544E-01	1.480E-03
	84	1.3358	550.0	7.3	7.875E-04	1.260E-05	64.0	0.8367	3.500E-01	1.463E-03
41	85	1.3721	550.0	7.3	7.857E-04	1.260E-05	64.0	0.8367	3.456E-01	1.447E-03
	86	1.4097	550.0	7.3	7.840E-04	1.260E-05	64.0	0.8367	3.410E-01	1.429E-03
42	87	1.4473	550.0	7.3	7.824E-04	1.260E-05	64.0	0.8367	3.366E-01	1.411E-03
	88	1.4862	550.0	7.3	7.809E-04	1.260E-05	64.0	0.8367	3.321E-01	1.392E-03
43	89	1.5251	550.0	7.3	7.795E-04	1.260E-05	64.0	0.8367	3.278E-01	1.374E-03
	90	1.5654	550.0	7.3	7.783E-04	1.260E-05	63.9	0.8367	3.234E-01	1.354E-03
44	91	1.6056	550.0	7.3	7.772E-04	1.260E-05	63.9	0.8367	3.193E-01	1.335E-03

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

BODY PT NO (J)	INTEG PT NO (I)	STREAM LENGTH INCH (S)	WALL TEMPERATURE DEG R (TW)	WALL ENTHALPY BTU/LBM (HW)	WALL DENSITY LBM/FT3 (ROW)	WALL VISCOSITY LBM/FT-SEC (VISW)	RECOVERY ENTHALPY BTU/LBM (HR)	RECOVERY FACTOR (RECOV)	SENSBL CONV HEAT FLUX BTU/FT2-SEC	
	92	1.6471	550.0	7.3	7.762E-04	1.260E-05	63.9	0.8367	3.151E-01	
45	93	1.6886	550.0	7.3	7.754E-04	1.260E-05	63.9	0.8367	3.111E-01	1.316E-03
	94	1.7314	550.0	7.3	7.748E-04	1.260E-05	63.9	0.8367	3.072E-01	1.297E-03
46	95	1.7742	550.0	7.3	7.742E-04	1.260E-05	63.9	0.8367	3.035E-01	1.278E-03
	96	1.8183	550.0	7.3	7.738E-04	1.260E-05	63.9	0.8367	2.999E-01	1.259E-03
47	97	1.8624	550.0	7.3	7.735E-04	1.260E-05	63.9	0.8367	2.965E-01	1.241E-03
	98	1.8927	550.0	7.3	7.733E-04	1.260E-05	63.9	0.8367	2.943E-01	1.224E-03
	99	1.9229	550.0	7.3	7.731E-04	1.260E-05	63.9	0.8367	2.922E-01	1.212E-03
48	100	1.9532	550.0	7.3	7.730E-04	1.260E-05	63.9	0.8367	2.901E-01	1.202E-03
	101	1.9843	550.0	7.3	7.728E-04	1.260E-05	63.9	0.8367	2.881E-01	1.191E-03
	102	2.0155	550.0	7.3	7.727E-04	1.260E-05	63.9	0.8367	2.862E-01	1.181E-03
49	103	2.0466	550.0	7.3	7.725E-04	1.260E-05	63.9	0.8367	2.843E-01	1.172E-03
	104	2.0786	550.0	7.3	7.724E-04	1.260E-05	63.9	0.8367	2.825E-01	1.162E-03
	105	2.1106	550.0	7.3	7.723E-04	1.260E-05	63.9	0.8367	2.807E-01	1.153E-03
50	106	2.1426	550.0	7.3	7.721E-04	1.260E-05	63.9	0.8367	2.790E-01	1.145E-03
										1.137E-03

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

VISCOUS FLOW - BOUNDARY LAYER SOLUTION

BODY PT NO (J)	INTEG PT NO (I)	STREAM LENGTH INCH (S)	MOMENTUM THICKNESS MIL (THE)	ENERGY THICKNESS MIL (PHI)	SHAPE FACTOR (HSF)	MOM THICK RE NO (RETH)	ENERGY THICK RE NO (REPH)	HEAT TRANS COEFFICIENT LBM/FT2-SEC (RUCH)	REYNOLDS ANAL FAC (RAF)	INTER-MITTENCY (ADML)	TRANSITION PARAMETER (TP)
1	1	0.0000	0.388	1.039	4.305	0.000E+00	0.000E+00	5.339E-02	0.5752	0.00	
	2	0.0034	0.388	1.039	4.305	4.974E-01	1.332E+00	5.330E-02	0.5751	0.00	
	3	0.0069	0.388	1.039	4.305	9.945E-01	2.664E+00	5.328E-02	0.5750	0.00	
	4	0.0103	0.387	1.040	4.307	1.489E+00	3.996E+00	5.326E-02	0.5739	0.00	
	5	0.0138	0.388	1.040	4.309	1.990E+00	5.329E+00	5.322E-02	0.5751	0.00	
	6	0.0172	0.389	1.041	4.312	2.489E+00	6.662E+00	5.318E-02	0.5753	0.00	
2	7	0.0207	0.389	1.042	4.315	2.988E+00	7.995E+00	5.312E-02	0.5755	0.00	
	8	0.0310	0.391	1.049	4.327	4.478E+00	1.199E+01	5.278E-02	0.5742	0.00	
3	9	0.0413	0.393	1.056	4.344	5.948E+00	1.599E+01	5.229E-02	0.5721	0.00	
	10	0.0517	0.394	1.065	4.366	7.404E+00	1.999E+01	5.172E-02	0.5698	0.00	
4	11	0.0620	0.396	1.075	4.394	8.842E+00	2.398E+01	5.103E-02	0.5673	0.00	
	12	0.0723	0.399	1.088	4.426	1.026E+01	2.798E+01	5.024E-02	0.5643	0.00	
5	13	0.0826	0.402	1.102	4.464	1.166E+01	3.198E+01	4.934E-02	0.5610	0.00	
	14	0.0930	0.405	1.119	4.508	1.303E+01	3.599E+01	4.835E-02	0.5572	0.00	
6	15	0.1033	0.410	1.139	4.557	1.438E+01	4.000E+01	4.724E-02	0.5530	0.00	
	16	0.1136	0.414	1.161	4.613	1.570E+01	4.402E+01	4.605E-02	0.5484	0.00	
7	17	0.1240	0.419	1.186	4.674	1.698E+01	4.806E+01	4.476E-02	0.5434	0.00	
	18	0.1343	0.425	1.214	4.742	1.824E+01	5.211E+01	4.343E-02	0.5370	0.00	
8	19	0.1446	0.432	1.245	4.817	1.947E+01	5.618E+01	4.195E-02	0.5326	0.00	
	20	0.1550	0.439	1.281	4.898	2.065E+01	6.027E+01	4.044E-02	0.5265	0.00	
9	21	0.1653	0.447	1.320	4.986	2.180E+01	6.439E+01	3.886E-02	0.5201	0.00	
	22	0.1756	0.455	1.363	5.081	2.286E+01	6.854E+01	3.726E-02	0.5124	0.00	
10	23	0.1860	0.464	1.410	5.187	2.394E+01	7.277E+01	3.572E-02	0.5036	0.00	
	24	0.1963	0.477	1.463	5.293	2.507E+01	7.693E+01	3.374E-02	0.5027	0.00	
11	25	0.2066	0.488	1.520	5.412	2.606E+01	8.121E+01	3.228E-02	0.4921	0.00	
	26	0.2170	0.501	1.583	5.535	2.707E+01	8.550E+01	3.051E-02	0.4869	0.00	
12	27	0.2273	0.517	1.651	5.663	2.812E+01	8.979E+01	2.878E-02	0.4828	0.00	
	28	0.2376	0.534	1.723	5.796	2.914E+01	9.409E+01	2.714E-02	0.4784	0.00	
13	29	0.2479	0.551	1.802	5.934	3.010E+01	9.840E+01	2.557E-02	0.4731	0.00	
	30	0.2583	0.568	1.886	6.078	3.097E+01	1.028E+02	2.410E-02	0.4658	0.00	
14	31	0.2686	0.584	1.977	6.233	3.170E+01	1.073E+02	2.271E-02	0.4557	0.00	
	32	0.2789	0.597	2.079	6.403	3.214E+01	1.119E+02	2.139E-02	0.4403	0.00	
15	33	0.2893	0.608	2.202	6.608	3.237E+01	1.171E+02	2.021E-02	0.4165	0.00	
	34	0.2996	0.623	2.338	6.825	3.268E+01	1.225E+02	1.868E-02	0.4018	0.00	
16	35	0.3099	0.643	2.486	7.052	3.315E+01	[illegible]	1.721E-02	0.3903	0.00	
	36	0.3203	0.675	2.645	7.285	3.411E+01	1.336E+02	1.582E-02	0.3855	0.00	
17	37	0.3306	0.712	2.769	7.446	3.547E+01	1.379E+02	1.411E-02	0.4080	0.00	
	38	0.3409	0.747	2.906	7.623	3.665E+01	1.425E+02	1.338E-02	0.4047	0.00	
18	39	0.3513	0.778	3.059	7.818	3.745E+01	1.473E+02	1.265E-02	0.3962	0.00	
	40	0.3616	0.804	3.234	8.037	3.793E+01	1.526E+02	1.191E-02	0.3833	0.00	
19	41	0.3719	0.834	3.436	8.283	3.845E+01	1.583E+02	1.115E-02	0.3699	0.00	
	42	0.3823	0.865	3.617	8.490	3.909E+01	1.634E+02	1.015E-02	0.3736	0.00	
20	43	0.3926	0.914	3.822	8.721	4.036E+01	1.688E+02	9.564E-03	0.3691	0.00	
	44	0.4029	0.978	3.913	8.804	4.287E+01	1.715E+02	8.128E-03	0.4329	0.00	

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

BODY PT NO (J)	INTEG PT NO (I)	STREAM LENGTH INCH (S)	MOMENTUM THICKNESS MIL (THE)	ENERGY THICKNESS MIL (PHI)	SHAPE FACTOR (HSF)	MOM THICK RE NO (RETH)	ENERGY THICK RE NO (REPH)	HEAT TRANS COEFFICIENT LBM/FT2-SEC (RUCH)	REYNOLDS ANAL FAC (RAF)	INTER-MITTENCY (ADML)	TRANSITION PARAMETER (TP)
21	45	0.4133	1.050	3.887	8.745	4.625E+01	1.713E+02	6.830E-03	0.5289	0.00	
	46	0.4249	1.134	3.659	8.683	5.027E+01	1.711E+02	6.919E-03	0.5749	0.00	
22	47	0.4365	1.214	3.835	8.626	5.413E+01	1.710E+02	6.999E-03	0.6189	0.00	
	48	0.4494	1.300	3.812	8.567	5.827E+01	1.709E+02	7.080E-03	0.6657	0.00	
23	49	0.4624	1.381	3.793	8.512	6.227E+01	1.710E+02	7.153E-03	0.7104	0.00	
	50	0.4766	1.468	3.775	8.456	6.651E+01	1.711E+02	7.223E-03	0.7575	0.00	
24	51	0.4908	1.550	3.762	8.405	7.061E+01	1.713E+02	7.285E-03	0.8023	0.00	
	52	0.5064	1.637	3.750	8.354	7.492E+01	1.716E+02	7.342E-03	0.8489	0.00	
25	53	0.5219	1.720	3.742	8.307	7.907E+01	1.720E+02	7.391E-03	0.8931	0.00	
	54	0.5387	1.806	3.737	8.261	8.341E+01	1.726E+02	7.434E-03	0.9384	0.00	
26	55	0.5556	1.889	3.735	8.219	8.757E+01	1.732E+02	7.468E-03	0.9811	0.00	
	56	0.5737	1.974	3.736	8.178	9.188E+01	1.739E+02	7.496E-03	1.0243	0.00	
27	57	0.5918	2.055	3.739	8.141	9.600E+01	1.747E+02	7.515E-03	1.0646	0.00	
	58	0.6112	2.138	3.746	8.105	1.002E+02	1.756E+02	7.527E-03	1.1048	0.00	
28	59	0.6307	2.217	3.756	8.073	1.042E+02	1.766E+02	7.531E-03	1.1420	0.00	
	60	0.6514	2.297	3.769	8.043	1.083E+02	1.777E+02	7.527E-03	1.1785	0.00	
29	61	0.6721	2.373	3.785	8.016	1.122E+02	1.789E+02	7.516E-03	1.2119	0.00	
	62	0.6941	2.450	3.804	7.991	1.161E+02	1.802E+02	7.497E-03	1.2442	0.00	
30	63	0.7162	2.522	3.825	7.969	1.198E+02	1.816E+02	7.472E-03	1.2734	0.00	
	64	0.7395	2.594	3.849	7.949	1.234E+02	1.831E+02	7.439E-03	1.3011	0.00	
31	65	0.7628	2.662	3.875	7.932	1.269E+02	1.847E+02	7.401E-03	1.3257	0.00	
	66	0.7874	2.730	3.905	7.917	1.303E+02	1.863E+02	7.356E-03	1.3486	0.00	
32	67	0.8120	2.793	3.936	7.904	1.335E+02	1.881E+02	7.307E-03	1.3686	0.00	
	68	0.8380	2.856	3.971	7.894	1.366E+02	1.899E+02	7.251E-03	1.3869	0.00	
33	69	0.8539	2.915	4.006	7.885	1.395E+02	1.918E+02	7.192E-03	1.4025	0.00	
	70	0.8911	2.972	4.045	7.878	1.424E+02	1.938E+02	7.128E-03	1.4163	0.00	
34	71	0.9183	3.026	4.085	7.873	1.450E+02	1.958E+02	7.062E-03	1.4278	0.00	
	72	0.9468	3.080	4.128	7.870	1.476E+02	1.979E+02	6.991E-03	1.4377	0.00	
35	73	0.9754	3.130	4.172	7.868	1.500E+02	2.000E+02	6.918E-03	1.4456	0.00	
	74	1.0052	3.179	4.219	7.867	1.524E+02	2.023E+02	6.842E-03	1.4521	0.00	
36	75	1.0350	3.225	4.266	7.868	1.546E+02	2.045E+02	6.784E-03	1.4551	0.00	
	76	1.0661	3.272	4.316	7.870	1.568E+02	2.069E+02	6.731E-03	1.4561	0.00	
37	77	1.0972	3.316	4.366	7.873	1.589E+02	2.092E+02	6.674E-03	1.4563	0.00	
	78	1.1296	3.360	4.419	7.876	1.610E+02	2.117E+02	6.611E-03	1.4560	0.00	
38	79	1.1620	3.403	4.472	7.881	1.630E+02	2.142E+02	6.545E-03	1.4553	0.00	
	80	1.1958	3.446	4.527	7.885	1.650E+02	2.167E+02	6.475E-03	1.4545	0.00	
39	81	1.2295	3.489	4.582	7.891	1.669E+02	2.192E+02	6.403E-03	1.4536	0.00	
	82	1.2645	3.531	4.639	7.896	1.689E+02	2.218E+02	6.328E-03	1.4528	0.00	
40	83	1.2995	3.574	4.696	7.902	1.708E+02	2.244E+02	6.253E-03	1.4522	0.00	
	84	1.3358	3.617	4.753	7.907	1.728E+02	2.270E+02	6.174E-03	1.4519	0.00	
41	85	1.3721	3.660	4.810	7.913	1.747E+02	2.297E+02	6.097E-03	1.4519	0.00	
	86	1.4097	[illegible]	4.869	7.918	1.767E+02	2.323E+02	6.018E-03	1.4524	0.00	
42	87	1.4473	3.748	4.926	7.923	1.788E+02	2.349E+02	5.940E-03	1.4533	0.00	
	88	1.4862	3.794	4.984	7.928	1.809E+02	2.376E+02	5.862E-03	1.4548	0.00	
43	89	1.5251	3.839	5.041	7.932	1.830E+02	2.402E+02	5.785E-03	1.4567	0.00	
	90	1.5654	3.887	5.099	7.936	1.851E+02	2.429E+02	5.709E-03	1.4592	0.00	
44	91	1.6056	3.934	5.156	7.940	1.873E+02	2.455E+02	5.635E-03	1.4621	0.00	

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

BODY PT NO (J)	INTEG PT NO (I)	STREAM LENGTH INCH (S)	MOMENTUM THICKNESS MIL (THE)	ENERGY THICKNESS MIL (PHI)	SHAPE FACTOR (HSF)	MOM THICK RE NO (RETH)	ENERGY THICK RE NO (REPH)	HEAT TRANS COEFFICIENT LBM/FT2-SEC (RUCH)	REYNOLDS ANAL FAC (RAF)	INTER-MITTENCY (ADML)	TRANSITION PARAMETER (TP)
	92	1.6471	3.983	5.213	7.943	1.896E+02	2.482E+02	5.562E-03	1.4654	0.00	
45	93	1.6886	4.032	5.270	[illegible]	1.919E+02	[illegible]	5.492E-03	1.4690	0.00	
	94	1.7314	4.083	5.326	7.947	1.943E+02	2.535E+02	5.424E-03	1.4730	0.00	
46	95	1.7742	4.134	5.382	7.949	1.967E+02	2.561E+02	5.359E-03	1.4771	0.00	
	96	1.8183	4.186	5.439	7.951	1.991E+02	2.587E+02	5.295E-03	1.4813	0.00	
47	97	1.8624	4.238	5.494	7.952	2.016E+02	2.613E+02	5.235E-03	1.4855	0.00	
	98	1.8927	4.274	5.531	7.952	2.033E+02	2.631E+02	5.195E-03	1.4885	0.00	
	99	1.9229	4.309	5.569	7.953	2.050E+02	2.649E+02	5.158E-03	1.4912	0.00	
48	100	1.9532	4.344	5.605	7.953	2.066E+02	2.666E+02	5.122E-03	1.4937	0.00	
	101	1.9843	4.380	5.643	7.954	2.083E+02	2.684E+02	5.087E-03	1.4962	0.00	
	102	2.0155	4.416	5.680	7.954	2.100E+02	2.701E+02	5.053E-03	1.4986	0.00	
49	103	2.0466	4.451	5.717	7.955	2.117E+02	2.719E+02	5.020E-03	1.5008	0.00	
	104	2.0786	4.487	5.755	7.955	2.134E+02	2.737E+02	4.988E-03	1.5028	0.00	
	105	2.1106	4.523	5.793	7.955	2.151E+02	2.755E+02	4.956E-03	1.5047	0.00	
50	106	2.1426	4.558	5.831	7.956	2.168E+02	2.772E+02	4.926E-03	1.5064	0.00	

SAMPLE PROBLEM 2

Swept Wing Configuration With

Transient Heat Conduction

Sample Problem 2 Input Data

```
     0    0    0    0
        BRL FLIGHT CASE (YUMA  TS=125 DEG-F. T0=60 DEG-F)
        TRANSIENT CONDUCTION SOLUTION -- PLNRASCC       05 JANUARY 1984
        12.5 DEG NOSE. 7 INCH BODY  < BRL SAMPLE PLANAR CASE> PLNR TEST
01     Program Constants and Time Information
     0.0         2.00
     4    0    1    5    0    1                0
     0.01        0.01
     0.25        0.25
01   0.25        2.00
02     Environment Table
     0.0         1.0          520.         5259.
     0.2         1.0          520.         5184
     0.4         1.0          520.         5082.
     0.6         1.0          520.         4941.
     0.8         1.0          520.         4793
     1.0         1.0          520.         4636.
     1.2         1.0          520.         4446.
     1.4         1.0          520.         4249
     1.6         1.0          520.         4035
     1.8         1.0          520.         3839
02   2.0         1.0          520.         3629
03     Surface Geometry and Grid Size
   -13
     0.2                                     1.5        585.        75.
    0.4507  0.0      1
    0.4627  0.0684   1
    0.4975  0.1286   1
    0.6074  0.1953   1
    0.8      .2380   1
    1.0      .2823   1
    1.249    .3375   1
    1.55     .3798   1
    1.9      .429    2
    3.0      .5836   2
    4.0      .7241   2
    5.5     0.9349   2
    7.0     1.1458   2
    34
    0.4507  0.0      1
    0.4627  0.0684   1
    0.4975  0.1286   1
    0.6074  0.1953   1
    0.8      .2380   1
    1.0      .2823   1
    1.249    .3375   1
    1.55     .3798   1
     1.875   .425    1
     1.94    .32     1
     1.76    .291    1
     1.76    .226    1
     1.268   .1571   1
     1.268   .0775   1
     0.80    .0775   1
     0.80   0.0      1
```

```
     0.4507 0.0      1
     0.80   0.0      2
     0.80    .0775   2
     1.76    .0775   2
     1.76    .281    2
     1.94    .32     2
     1.875   .425    2
    2.0      .4431   2
    4.0      .7241   2
    6.0     1.0052   2
    7.0     1.1458   2
     7.0    0.0      2
     0.60   0.0      2
     1.268   .0775   3
     1.268   .1571   3
     1.76    .2260   3
     1.76    .0775   3
     1.268   .0775   3
03   7.0             0.0
    11
     .1
     .12
    60   22
   0.1186        0.1186      0.1186      0.1186      0.1186      0.1186
   0.1186        0.1186      0.1186      0.1186      0.1186      0.1186
   0.1186        0.1186      0.1186      0.1186      0.1186      0.1186
   0.1186        0.1186      0.1186      0.1186      0.1186      0.1186
   0.1186        0.1186      0.1186      0.1186      0.1186      0.1186
   0.1186        0.1186      0.1186      0.1186      0.1186      0.1186
   0.1186        0.1186      0.1186      0.1186      0.1186      0.1186
   0.1186        0.1185      0.1186      0.1186      0.1186      0.1186
   0.1186        0.1186      0.1186      0.1186      0.1186      0.1186
   0.1186        0.1186      0.1186      0.1186      0.1186
   0.055         0.055         0.055         0.055         0.055         0.055
   0.055         0.055         0.055         0.055         0.055         0.055
   0.055         0.055         0.055         0.055         0.055         0.055
   0.055         0.055         0.055         0.055         0.055         0.055
06   Material Properties Table
     1    0    1
    10.0           0.0

    418.08      536.0        0.0

     400.          .083        1.794E-02         .15
     500.          .088        1.805E-02         .15
     600.          .093        1.790E-02         .15
     700.          .098        1.758E-02         .15
     800.          .103        1.718E-02         .15
     900.          .108        1.670E-02         .15
    1000.          .112        1.618E-02         .15
    1100.          .117        1.563E-02         .15
-1  1200.          .122        1.506E-02         .15
     2    0    1
    10.0           0.0

    490.        536.0          0.0
```

```
     492.          .11            7.360E-03        .60
     672.          .11            7.220E-02        .60
    1032.          .11            6.940E-02        .60
 -1 1392.          .11            6.110E-03        .60
    3     0     1
   0.0              0 0

   488.8          536
   117.0          3310            50.          128          .1932
    540.          .128            7 56E-03          5
   3250.          .128            7.56E-03         .5
   3320.          .1932           2.10E-03          5
 +1 9000.         .1932           2 10E-03         .5
    1     2   1.0E-05
    1     3   1.0E-04
    2     3   1.0E-06

07        Surface Pressure Table
    4     1
    60.           5.
   +1
08        Shock Shape Table
    3
09        Surface Chemistry Tables
    1
    1.0
 1.00       .00    99 00    662.210    00    99.556    58.744    1   A[illegible]        .990+02
 1.00       .00    10 00    659.444   .00    89.850    58.408    1   A[illegible]        .100+02
 1.00       .00     1.00    656.666   .00    89.128    58.087    1   A[illegible]        .100+01
 1.00       .00      01     653.888   .00    88 405    57.765    1   A[illegible]        .100-01
 1.00       .00      001    600.000   .00    74.555    74.555    1   A[illegible]
 1.00       .00     .0001   298.000   .00     0.         0.      1   A[illegible]
 1.00       .00      00001  200.000   .00   -42 130   -42.130    1   A[illegible]

    2
    1.0
 1.00       .00     .01     2500.00   .00   525.096   525.096    1   Al[illegible]
 1.00       .00     .001    600.000   .00    74.555    74.555    1   Al[illegible]
 1.00       .00     .0001   298.000   .00     0.         0.      1   A[illegible]
 1.00       .00     .00001  200.000   .00   -42 130   -42.130    1   A[illegible]

    3
    1.0
 1.00       .00     .01     2500.00   .00   525.096   525.096    1   Al[illegible]
 1.00       .00     .001    600.000   .00    74.555    74.555    1   Al[illegible]
 1.00       .00     .0001   298.000   .00     0.         0.      1   Al[illegible]
 1.00       .00     .00001  200.000   .00   -42 130   -42.130    1   Al[illegible]

-1
   -1
```

Sample Problem 2 Output

```
              PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

                                     *************
************************************ I N P U T ***************************************
                                     *************

          BRL FLIGHT CASE (YUMA  TS=125 DEG-F, T0=60 DEG-F)
          TRANSIENT CONDUCTION SOLUTION -- PLNRASCC      05 JANUARY 1984
          12.5 DEG NOSE, 7 INCH BODY  &lt; BRL SAMPLE PLANAR CASE&gt; PLNR TEST

                          -- GENERAL PROGRAM FLAGS --

              (ENVIRONMENT FLAG)                        LC = 4
              (SHAPE CHANGE FLAG)                      ISS = 0
              (OUTPUT PRINT FLAG)                    IPRNT = 1
              (TRANSITION CRITERIA FLAG)            NREYCR = 5
              (BODY ANGLE DEFN. FLAG)                 IRON = 0
              (CARBON TRANS. CRIT. FLAG)             ICARB = 1
              (NOSE SHAPE MODIFICATION FLAG)          IMOD = 0

                        -- TIME INCREMENT INFORMATION --

       INITIAL TIME (SEC)     0.0000            FINAL TIME (SEC)    2.0000

       OUTPUT INTERVAL =  0.0100 SEC FROM   INITIAL TIME UNTIL    0.0100 SEC
       OUTPUT INTERVAL =  0.2500 SEC FROM     0.0100 SEC UNTIL    0.2500 SEC
       OUTPUT INTERVAL =  0.2500 SEC FROM     0.2500 SEC UNTIL FINAL TIME

                    ************************************
                    TIME STEP STABILITY CRITERIA IN EFFECT
                    ************************************

                    MINIMUM TIME STEP = 1.000E-06 SECONDS
```

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

--- GENERAL ENVIRONMENT ---

TIME (SEC)	PRESSURE (ATM)	TEMPERATURE (DEG R)	VELOCITY (FPS)
0.000	1.000	520.00	5259.00
0.200	1.000	520.00	5184.00
0.400	1.000	520.00	5082.00
0.600	1.000	520.00	4941.00
0.800	1.000	520.00	4793.00
1.000	1.000	520.00	4636.00
1.200	1.000	520.00	4446.00
1.400	1.000	520.00	4249.00
1.600	1.000	520.00	4035.00
1.800	1.000	520.00	3839.00
2.000	1.000	520.00	3629.00

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

— INITIAL GEOMETRY —

GENERAL SHAPE

INITIAL NOSE RADIUS = 0.2000 INCHES

GENERAL INTERFACE OPTION

PLUG OPTION

MAXIMUM •Z• = 7.0000 INCHES
ORIGIN OF RAYS (Z) = 1.5000 INCHES
ORIGIN OF RAYS (R) = 0.0000 INCHES

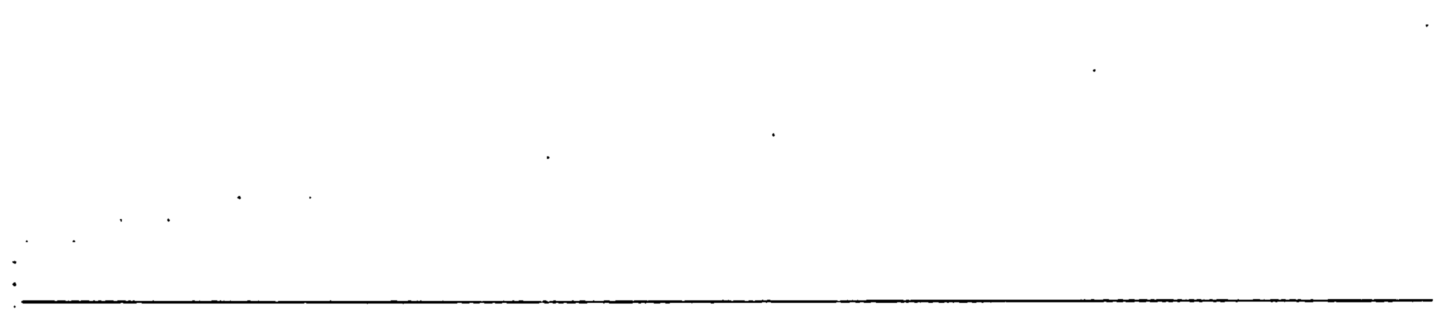
BODY POINT INDEX	SURFACE COORDINATES Z (INCH)	R (INCH)	THETA (DEG)	MATERIAL INDEX	OUTER INTERFACE COORDINATES Z (INCH)	R (INCH)	MATERIAL INDEX	INNER INTERFACE COORDINATES Z (INCH)	R (INCH)	MATERIAL INDEX
1	0.4507	0.0000	90.00	1	0.8000	0.0000	2	0.8000	0.0000	2
2	0.4627	0.0684	70.02	1	0.8000	0.0462	2	0.8000	0.0462	2
3	0.4975	0.1286	49.97	1	0.8959	0.0775	2	0.8959	0.0775	2
4	0.6074	0.1953	23.87	1	1.1458	0.0775	2	1.1458	0.0775	2
5	0.8000	0.2380	12.49	1	1.2680	0.0789	3	1.2721	0.0775	2
6	1.0000	0.2823	12.50	1	1.2680	0.1310	3	1.3627	0.0775	2
7	1.2490	0.3375	10.45	1	1.3723	0.1717	3	1.4424	0.0775	2
8	1.5500	0.3798	8.00	1	1.5500	0.1966	3	1.5500	0.0775	2
9	1.9000	0.4290	8.00	2	1.9000	0.3846	1	1.9000	0.3136	2
10	3.0000	0.5836	8.00	2	3.0000	0.5836	2	3.0000	0.5836	2
11	4.0000	0.7241	8.00	2	4.0000	0.7241	2	4.0000	0.7241	2
12	5.5000	0.9349	8.00	2	5.5000	0.9349	2	5.5000	0.9349	2
13	7.0000	1.1458	8.00	2	7.0000	1.1458	2	7.0000	1.1458	2

THE FOLLOWING POINTS ARE ON THE PLUG

BODY POINT INDEX	Z (INCH)	R (INCH)
14	7.0000	1.1458
15	7.0000	0.0000

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

*** INITIAL SHAPE OF NOSETIP ***



—IMPLICIT NODE SPACING—
NODE THICKNESS IN INCHES

NODE NO. / BODY PT NO.	1	2	3	4	5	6	7	8	9	10	11
1	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	
2	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	
3	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	
4	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	
5	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	
6	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	
7	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	
8	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	
9	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	
10	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	
11	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	
12	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	
13	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	

```
                    ---- EXPLICIT GRID GEOMETRY ----

                     NUMBER OF COLUMNS    =     60
                     NUMBER OF ROWS       =     22

                     VARIABLE GRID SPACING WITH
                     X GRID SPACING =
0.11860      0.11860      0.11860      0.11860      0.11860
0.11860      0.11860      0.11860      0.11860      0.11860
0.11860      0.11860      0.11860      0.11860      0.11860
0.11860      0.11860      0.11860      0.11860      0.11860
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0.11860      0.11860      0.11860      0.11860      0.11860
0.11860      0.11860      0.11860      0.11860      0.11860
0.11860      0.11860      0.11860      0.11860      0.11860
0.11860      0.11860      0.11860      0.11860
             Y GRID SPACING =
0.05500      0.05500      0.05500      0.05500      0.05500
0.05500      0.05500      0.05500      0.05500      0.05500
0.05500      0.05500      0.05500      0.05500      0.05500
0.05500      0.05500      0.05500      0.05500      0.05500
0.05500

          INITIAL TEMPERATURE OF MODEL =  585.0 DEG R

MAXIMUM DESIRED SURFACE TEMPERATURE RISE BETWEEN TIME STEPS =   75.0 DEG R

MINIMUM EXPLICIT NODAL SPACING USED IN TIME STEP COMPUTATION =  0.0550 INCH
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PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

—— MATERIAL FLAG INDEX ——

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2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
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PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

---MATERIAL PROPERTIES---

••••••• M A T E R I A L   N U M B E R   1 •••••••

--- SURFACE ROUGHNESS ---

ROUGHNESS HEIGHT FOR TRANSITION	K-LAM =	10.000	(MIL)
ROUGHNESS HEIGHT FOR TURBULENT HEATING	K-TURB =	0.000	(MIL)
LAMINAR HEATING AUGMENTATION FLAG	JROUGH =	1	

--- PARAMETERS IN BLOWING CORRECTION TO TRANSFER COEFFICIENTS ---

LAMINAR SHEAR PARAMETER	(BLS) =	0.5000
LAMINAR HEATING PARAMETER	(BLH) =	0.5000
TURBULENT SHEAR PARAMETER	(BTS) =	0.3500
TURBULENT HEATING PARAMETER	(BTH) =	0.3500

--- THERMAL PROPERTIES ---

MATERIAL DENSITY	(RHO) =	418.08	(LBM/FT3)
DATUM TEMP FOR HEAT OF FORMATION	(TFO) =	536.00	(DEG R)
HEAT OF FORMATION	(HFO) =	0.00	(BTU/LBM)

TEMPERATURE (DEG R)	SPECIFIC HEAT (BTU/LB-DEG)	CONDUCTIVITY (BTU/FT-SEC-DEG)	SENSIBLE ENTHALPY (BTU/LB)	EMISSIVITY
400.00	0.0830	0.0179400	-11.81	0.1500
500.00	0.0880	0.0180500	-3.26	0.1500
600.00	0.0930	0.0179000	5.79	0.1500
700.00	0.0980	0.0175800	15.34	0.1500
800.00	0.1030	0.0171800	25.39	0.1500
900.00	0.1080	0.0167000	35.94	0.1500
1000.00	0.1120	0.0161800	46.94	0.1500
1100.00	0.1170	0.0156300	58.39	0.1500
1200.00	0.1220	0.0150600	70.34	0.1500

--- EROSION LAW MATERIAL FLAG ---

NERODE = 0

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

******* M A T E R I A L   N U M B E R   2 *******

— SURFACE ROUGHNESS —

ROUGHNESS HEIGHT FOR TRANSITION	K-LAM =	10.000 (MIL)
ROUGHNESS HEIGHT FOR TURBULENT HEATING	K-TURB =	0.000 (MIL)
LAMINAR HEATING AUGMENTATION FLAG	JROUGH =	1

— PARAMETERS IN BLOWING CORRECTION TO TRANSFER COEFFICIENTS —

LAMINAR SHEAR PARAMETER	(BLS) =	0.5000
LAMINAR HEATING PARAMETER	(BLH) =	0.5000
TURBULENT SHEAR PARAMETER	(BTS) =	0.3500
TURBULENT HEATING PARAMETER	(BTH) =	0.3500

— THERMAL PROPERTIES —

MATERIAL DENSITY	(RHO) =	490.00 (LBM/FT3)
DATUM TEMP FOR HEAT OF FORMATION	(TFO) =	536.00 (DEG R)
HEAT OF FORMATION	(HFO) =	0.00 (BTU/LBM)

TEMPERATURE (DEG R)	SPECIFIC HEAT (BTU/LB-DEG)	CONDUCTIVITY (BTU/FT-SEC-DEG)	SENSIBLE ENTHALPY (BTU/LB)	EMISSIVITY
492.00	0.1100	0.0073600	-4.84	0.6000
672.00	0.1100	0.0722060	14.96	0.6000
1032.00	0.1100	0.0694000	54.56	0.6000
1392.00	0.1100	0.0061100	94.16	0.6000

— EROSION LAW MATERIAL FLAG —

NERODE = 0

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

******* M A T E R I A L   N U M B E R   3 *******

— SURFACE ROUGHNESS —

ROUGHNESS HEIGHT FOR TRANSITION   K-LAM = 0.000 (MIL)
ROUGHNESS HEIGHT FOR TURBULENT HEATING   K-TURB = 0.000 (MIL)

LAMINAR HEATING AUGMENTATION FLAG   JPOUCH = 1

— PARAMETERS IN BLOWING CORRECTION TO TRANSFER COEFFICIENTS —

LAMINAR SHEAR PARAMETER (BLS) = 0.5000
LAMINAR HEATING PARAMETER (BLH) = 0.5000
TURBULENT SHEAR PARAMETER (BTS) = 0.3500
TURBULENT HEATING PARAMETER (BTH) = 0.3500

— THERMAL PROPERTIES —

MATERIAL DENSITY (RHO) = 488.80 (LBM/FT3)
DATUM TEMP FOR HEAT OF FORMATION (TFO) = 536.00 (DEG R)
HEAT OF FORMATION (HFO) = 0.00 (BTU/LBM)
LATENT HEAT OF FUSION (XLATHT) = 117.00 (BTU/LBM)
MELT TEMPERATURE (TMELT) = 3310.00 (DEG R)
TEMP DIFFERENCE MELT OCCURS (DTMELT) = 50.00 (R DEG)
SPECIFIC HEAT OF SOLID (CPSOLD) = 1.280E-01 (BTU/LBM-DEG R)
SPECIFIC HEAT OF LIQUID (CPLIQD) = 1.932E-01 (BTU/LBM-DEG R)

TEMPERATURE (DEG R)	SPECIFIC HEAT (BTU/LB-DEG)	CONDUCTIVITY (BTU/FT-SEC-DEG)	SENSIBLE ENTHALPY (BTU/LB)	EMISSIVITY
540.00	0.1280	0.0075600	0.51	0.5000
3250.00	0.1280	0.0075600	347.39	0.5000
3285.00	0.1280	0.0048300	351.87	0.5000
3335.00	4.5520	0.0021000	468.87	0.5000
3336.00	0.1932	0.0021000	471.24	0.5000
9000.00	0.1932	0.0021000	1565.53	0.5000

— EROSION LAW MATERIAL FLAG —

NERODE = 0

CONTACT RESISTANCES

MAT1	MAT2	RESISTANCE (Ft**2-S-DegR/BTU)
1	2	1.00000E-05
1	3	1.00000E-04
2	3	1.00000E-06

PLANAR SWEPT WING CASE

SWEPT WING ANGLE = 60.00000 (DEG) WEDGE ANGLE = 5.00000 (DEG)

2-D CYLINDER-WEDGE PRESSURE CORRELATIONS ARE USED

MACH NUMBER NORMAL TO LEADING EDGE = 2.34182

— SHOCK SHAPE —

DIMENSIONLESS Y-COORDINATE Y/RN	SHOCK ANGLE (DEGREES)	DIMENSIONLESS X-COORDINATE X/RN
0.000	90.000	0.000
0.100	88.772	0.000
0.200	87.276	0.000
0.300	85.819	0.000
0.400	84.400	0.000
0.500	83.016	0.000
0.600	81.673	0.000
0.700	80.363	0.000
0.800	79.090	0.000
0.900	77.850	0.000
1.000	76.645	0.000
1.100	75.474	0.000
1.200	74.335	0.000
1.300	73.228	0.000
1.400	72.153	0.000
1.500	71.109	0.000
1.600	70.096	0.000
1.700	69.112	0.000
1.800	68.157	0.000
1.900	67.230	0.000
2.000	66.332	0.000
2.100	65.460	0.000
2.200	64.615	0.000
2.300	63.797	0.000
2.400	63.003	0.000
2.500	62.235	0.000
2.600	61.491	0.000
2.700	60.770	0.000
2.800	60.073	0.000
2.900	59.397	0.000
3.000	58.744	0.000
3.100	58.113	0.000
3.200	57.562	0.000
3.300	56.911	0.000
3.400	56.340	0.000
3.500	55.788	0.000
3.600	55.255	0.000
3.700	54.739	0.000
3.800	54.242	0.000
3.900	53.761	0.000
4.000	53.297	0.000
4.100	52.849	0.000
4.200	52.416	0.000
4.300	51.999	0.000

4.400	51.596	0.000
4.500	51.207	0.000
4.600	50.832	0.000
4.700	50.470	0.000
4.800	50.120	0.000
4.900	49.783	0.000
5.000	49.458	0.000
5.100	49.144	0.000
5.200	48.841	0.000
5.300	48.549	0.000
5.400	48.267	0.000
5.500	47.995	0.000
5.600	47.732	0.000
5.700	47.478	0.000
5.800	47.233	0.000
5.900	46.996	0.000
6.000	46.767	0.000
6.100	46.546	0.000
6.200	46.332	0.000
6.300	46.125	0.000
6.400	45.925	0.000
6.500	45.731	0.000
6.600	45.543	0.000
6.700	45.361	0.000
6.800	45.184	0.000
6.900	45.012	0.000
7.000	44.846	0.000
7.100	44.684	0.000
7.200	44.527	0.000
7.300	44.373	0.000
7.400	44.224	0.000
7.500	44.079	0.000
7.600	43.937	0.000
7.700	43.798	0.000
7.800	43.663	0.000
7.900	43.531	0.000
8.000	43.401	0.000
8.100	43.274	0.000
8.230	43.113	0.000
8.399	42.909	0.000
8.619	42.653	0.000
8.904	42.332	0.000
9.276	41.933	0.000
9.758	41.438	0.000
10.386	40.827	0.000
11.201	40.080	0.000
12.262	39.198	0.000
13.641	38.263	0.000
15.433	37.455	0.000
17.763	37.112	0.000
20.791	36.538	0.000
24.729	35.711	0.000
29.847	34.637	0.000
36.501	33.240	0.000
45.152	31.424	0.000
56.397	30.406	0.000
71.017	30.406	0.000

---SURFACE EQUILIBRIUM DATA---

MAT = 1
CMH = 1.00000

MASS TRANSFER COEF. = 0.0000 LBM/FT**2-SEC PRESSURE = 1.0000 ATM

TEMP	BPRIM	HCH	TSEN	TCHEM	SPECIE
360.0000	0.0000	-15.2280	-75.8340	75.8346	AIR
536.4000	0.0001	0.0362	0.0000	0.0000	AIR
1080.0000	0.0010	56.1020	134.1990	-134.2771	AIR
1176.9984	0.0100	67.5933	103.9770	-159.4928	AC41
1181.9988	1.0000	68.1909	104.5566	-196.7961	AC41
1186.9992	10.0000	68.7884	105.1344	-525.1900	AC41
1191.9780	99.0000	69.3834	105.7392	-3778.4279	AC41

MAT = 2
CMH = 1.00000

MASS TRANSFER COEF. = 0.0000 LBM/FT**2-SEC PRESSURE = 1.0000 ATM

TEMP	BPRIM	HCH	TSEN	TCHEM	SPECIE
360.0000	0.0000	-19.3600	-75.8340	75.8346	AIR
536.4000	0.0001	0.0440	0.0000	0.0000	AIR
1080.0000	0.0010	59.8400	134.1990	-134.2734	AIR
4500.0000	0.0100	436.0400	945.1728	-950.2641	AIR

MAT = 3
CMH = 1.00000

MASS TRANSFER COEF. = 0.0000 LBM/FT**2-SEC PRESSURE = 1.0000 ATM

TEMP	BPRIM	HCH	TSEN	TCHEM	SPECIE
360.0000	0.0000	-22.5280	-75.8340	75.8345	AIR
536.4000	0.0001	0.0512	0.0000	0.0000	AIR
1080.0000	0.0010	69.6320	134.1990	-134.2636	AIR
4500.0000	0.0100	696.1294	945.1728	-947.6632	AIR

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

— ENVIRONMENT HISTORY FOR THE INITIAL BODY SHAPE —

	— FREESTREAM QUANTITIES —			— SONIC POINT QUANTITIES —	— STAGNATION POINT QUANTITIES —		
TIME (SEC)	VELOCITY (FT/SEC)	TEMPERATURE (DEG R)	PRESSURE (ATM)	TRANSITION PARAMETER	PRESSURE (ATM)	ENTHALPY (BTU/LBM)	HEAT TRANS. COEF. (LBM/FT2-SEC)
0.000	5259.0	520.000	1.0000E+00	6470.78	2.9143E+01	552.4	1.674
0.200	5184.0	520.000	1.0000E+00	6350.23	2.8333E+01	536.8	1.611
0.400	5082.0	520.000	1.0000E+00	6186.60	2.7258E+01	515.9	1.574
0.600	4941.0	520.000	1.0000E+00	5959.44	2.5780E+01	487.7	1.523
0.800	4793.0	520.000	1.0000E+00	5706.09	2.4203E+01	458.9	1.468
1.000	4636.0	520.000	1.0000E+00	5457.58	2.2677E+01	429.3	1.412
1.200	4446.0	520.000	1.0000E+00	5158.48	2.0897E+01	394.9	1.345
1.400	4249.0	520.000	1.0000E+00	4850.47	1.9131E+01	360.7	1.277
1.600	4035.0	520.000	1.0000E+00	4524.08	1.7304E+01	325.3	1.203
1.800	3839.0	520.000	1.0000E+00	4231.03	1.5714E+01	294.4	1.136
2.000	3629.0	520.000	1.0000E+00	3896.28	1.4012E+01	263.1	1.062

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

SUMMARY
****

ENVIRONMENT NO	SHAPE NO	TIME SEC
(NT)	(MT)	(TIMEP)
1	1	0.0000

FREESTREAM MACH NO	FREESTREAM UNIT RE NO 1/FT	STAGNATION PT ENTHALPY BTU/LBM	STAGNATION PT PRESSURE ATM	ISENTROPIC EXPONENT BEHIND SHOCK	NOSE RADIUS INCH	INVISCID SONIC STREAM LENGTH INCH
(AMACH)	(UR1)	(HT2)	(PT2)	(GAM2)	(RN)	(SSONIC)
2.34	1.6522E+07	552.5	7.559	1.383	0.1988	0.1878

STAGNATION POINT					
SURFACE TEMPERATURE DEG R	RECESSION INCH	HEAT TRANSFER COEFFICIENT LBM/FT2-SEC	CURVED SHOCK HEAT TRANSFER AUG	TRANS PROXIMITY HEAT TRANSFER AUG	ROUGHNESS HEIGHT MIL
(TSTAGP)	(ZSTAGP)	(RUCH(1))	(HETAUG)	(RUFSMT(1))	(RUF(1))
585.0	0.0000	2.1673	1.0001	3.5784	10.0000

NOSETIP DRAG COEF NORM BY 2*RNI	SONIC STREAM LENGTH INCH	SONIC UNIT REYNOLDS NO 1/FT	AXIAL RECESSION AT R = 0.24 INCH INCH	TRANSITION STREAM LENGTH INCH
(CDRAG)	(SSTR)	(URESTR)	(ZSIDE)	(STRAN)
1.187	0.1786	1.4207E+07	0.0000	.298E-01

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

BODY SHAPE AND INVISCID FLOW INFORMATION
****

BODY PT NO (J)	INTEG PT NO (I)	STREAM LENGTH INCH (S)	AXIAL LENGTH INCH (Z)	TRANSVERSE LENGTH INCH (Y)	BODY ANGLE DEG (THETB)	PRESSURE RATIO (PEPI)	SHOCK PT NO (L)	SHOCK AXIAL LENGTH INCH (XSHC)	SHOCK RADIAL LENGTH INCH (YSHC)	SHOCK ANGLE DEG (BETA)	ENTROPY BEHIND SHOCK BTU/LBM-DEG R (SRB)
1	1	0.0000	0.4507	0.0000	90.00	1.000000	1	0.4507	0.0000	90.00	1.67902
2	8	0.0694	0.4627	0.0684	70.02	0.890602	8	0.4507	0.1400	80.36	1.67725
3	15	0.1390	0.4975	0.128[illegible]	49.97	0.628966	15	0.4507	0.2800	72.15	1.67306
4	24	0.2675	0.6074	0.1953	23.87	0.174174	24	0.4507	0.4600	63.80	1.66663
5	28	0.4648	0.8000	0.2389	12.49	0.168105	28	0.4507	0.5400	60.77	1.66387
6	32	0.6697	1.0000	0.2823	12.50	0.212319	32	0.4507	0.6200	58.11	1.66131
7	37	0.9247	1.2490	0.3375	10.45	0.210950	37	0.4507	0.7200	55.25	1.65846
8	43	1.2287	1.5500	0.3798	8.00	0.208845	43	0.4507	0.8400	52.42	1.65557
9	49	1.5821	1.9000	0.4290	8.00	0.204238	49	0.4507	0.9600	50.12	1.65331
10	67	2.6929	3.0000	0.5836	8.00	0.200391	67	0.4507	1.3200	45.54	1.64897
11	83	3.7027	4.0000	0.7241	8.00	0.199219	83	0.4507	1.6460	43.11	1.64683
12	107	5.2175	5.5000	0.9349	8.00	0.197501					
13	131	6.7322	7.0000	1.1458	8.00	0.196244					

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

VISCOUS FLOW - EDGE PROPERTIES

BODY PT NO (J)	INTEG PT NO (I)	STREAM LENGTH INCH (S)	VELOCITY FT/SEC (UE)	MACH NO (HCAM)	ENTHALPY BTU/LBM (HE)	TEMPERATURE DEG R (TE)	DENSITY LBM/FT3 (ROE)	VISCOSITY LBM/FT-SEC (VISE)	UNIT RE NO 1/FT (URE)
1	1	0.0000	0.0	0.0000	137.5	1075.9	2.776E-01	2.024E-05	0.000E+00
2	8	0.0694	651.3	0.4133	129.0	1043.0	2.550E-01	1.983E-05	8.375E+06
3	15	0.1390	1271.7	0.8433	105.2	950.0	1.977E-01	1.864E-05	1.349E+07
4	24	0.2675	2269.4	1.7929	34.7	664.1	7.833E-02	1.450E-05	1.226E+07
5	28	0.4648	2287.1	1.8161	33.1	657.4	7.637E-02	1.439E-05	1.213E+07
6	32	0.6697	2164.3	1.6621	44.0	702.9	9.022E-02	1.511E-05	1.292E+07
7	37	0.9247	2168.0	1.6665	43.7	701.5	8.980E-02	1.509E-05	1.290E+07
8	43	1.2287	2173.6	1.6732	43.2	699.5	8.917E-02	1.506E-05	1.287E+07
9	49	1.5821	2186.0	1.6881	42.1	695.0	8.776E-02	1.499E-05	1.280E+07
10	67	2.6929	2196.6	1.7011	41.2	691.2	8.659E-02	1.493E-05	1.274E+07
11	83	3.7027	2200.1	1.7054	40.9	689.9	8.624E-02	1.491E-05	1.273E+07
12	107	5.2175	2205.1	1.7116	40.4	688.0	8.573E-02	1.488E-05	1.270E+07
13	131	6.7322	2209.3	1.7168	40.0	686.5	8.538E-02	1.486E-05	1.270E+07

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

VISCOUS FLOW - WALL AND B. L. RECOVERY PROPERTIES

BODY PT NO (J)	INTEG PT NO (I)	STREAM LENGTH INCH (S)	WALL TEMPERATURE DEG R (TW)	WALL ENTHALPY BTU/LBM (HW)	WALL DENSITY LBM/FT3 (ROW)	WALL VISCOSITY LBM/FT-SEC (VISW)	RECOVERY ENTHALPY BTU/LBM (HR)	RECOVERY FACTOR (RECOV)	SENSBL CONV HEAT FLUX BTU/FT2-SEC	CF/2
1	1	0.0000	585.0	15.7	5.105E-01	1.320E-05	484.7	0.8367	1.016E+03	1.000E+30
2	8	0.0694	585.0	15.7	4.547E-01	1.320E-05	505.0	0.8879	4.906E+02	1.688E-02
3	15	0.1390	585.0	15.7	3.211E-01	1.320E-05	502.3	0.8879	5.578E+02	1.140E-02
4	24	0.2675	585.0	15.7	8.892E-02	1.320E-05	494.4	0.8879	1.972E+02	6.194E-03
5	28	0.4648	585.0	15.7	8.582E-02	1.320E-05	494.2	0.8879	1.618E+02	3.576E-03
6	32	0.6697	585.0	15.7	1.084E-01	1.320E-05	495.5	0.8879	1.853E+02	3.233E-03
7	37	0.9247	585.0	15.7	1.077E-01	1.320E-05	495.4	0.8879	1.736E+02	2.886E-03
8	43	1.2287	585.0	15.7	1.066E-01	1.320E-05	495.4	0.8879	1.631E+02	2.632E-03
9	49	1.5821	585.0	15.7	1.043E-01	1.320E-05	495.3	0.8879	1.526E+02	2.427E-03
10	67	2.6929	585.0	15.7	1.023E-01	1.320E-05	495.2	0.8879	1.364E+02	2.097E-03
11	83	3.7027	585.0	15.7	1.017E-01	1.320E-05	495.1	0.8879	1.283E+02	1.936E-03
12	107	5.2175	585.0	15.7	1.008E-01	1.320E-05	495.1	0.8879	1.200E+02	1.783E-03
13	131	6.7322	585.0	15.7	1.002E-01	1.320E-05	495.0	0.8879	1.142E+02	1.680E-03

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

VISCOUS FLOW - BOUNDARY LAYER SOLUTION

BODY PT NO (J)	INTEG PT NO (I)	STREAM LENGTH INCH (S)	MOMENTUM THICKNESS MIL (THE)	ENERGY THICKNESS MIL (PHI)	SHAPE FACTOR (HSF)	MOM THICK RE NO (RETH)	ENERGY THICK RE NO (REPH)	HEAT TRANS COEFFICIENT LBM/FT2-SEC (RUCH)	REYNOLDS ANAL FAC (RAF)	INTER-MITTENCY (ADML)	TRANSITION PARAMETER (TP)
1	1	0.0000	0.373	0.726	1.033	0.000E+00	0.000E+00	2.167E+00	0.7351	0.00	0.000
2	8	0.0694	0.383	0.747	1.441	2.671E+02	5.210E+02	1.003E+00	0.3577	1.00	0.000
3	15	0.1390	0.483	0.781	1.767	5.428E+02	8.787E+02	1.146E+00	0.3997	1.00	0.000
4	24	0.2675	0.607	1.670	3.139	6.204E+02	1.706E+03	4.120E-01	0.3742	1.00	0.000
5	28	0.4648	1.272	2.001	3.029	1.287E+03	2.023E+03	3.382E-01	0.5415	1.00	0.000
6	32	0.6697	2.131	2.137	2.647	2.295E+03	2.301E+03	3.863E-01	0.6120	1.00	0.000
7	37	0.9247	2.903	2.584	2.608	3.121E+03	2.778E+03	3.619E-01	0.6441	1.00	0.000
8	43	1.2287	3.715	3.085	2.584	3.984E+03	3.309E+03	3.401E-01	0.6667	1.00	0.000
9	49	1.5821	4.574	3.655	2.580	4.879E+03	3.898E+03	3.183E-01	0.6837	1.00	0.000
10	67	2.6929	7.017	5.249	2.541	7.450E+03	5.573E+03	2.846E-01	0.7135	1.00	0.000
11	83	3.7027	9.025	6.572	2.513	9.572E+03	6.970E+03	2.677E-01	0.7285	1.00	0.000
12	107	5.2175	11.793	8.446	2.486	1.249E+04	8.942E+03	2.503E-01	0.7426	1.00	0.000
13	131	6.7322	14.366	10.214	2.468	1.520E+04	1.081E+04	2.383E-01	0.7521	1.00	0.000

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

VISCOUS FLOW - CURVED SHOCK AND ROUGHNESS EFFECTS

BODY PT NO (J)	INTEG PT NO (I)	STREAM LENGTH INCH (S)	CURVED SHOCK EFFECTS: EDGE ENTROPY BTU/LBM-DEG R (ENTR)	CURVED SHOCK EFFECTS: EDGE STREAMLINE LOCATION AT SHOCK INCH (YBAR)	CURVED SHOCK EFFECTS: EDGE MASS FLUX AUGMENTATION (ROUE)	SURFACE ROUGHNESS EFFECTS: ROUGHNESS MIL (RUF)	SURFACE ROUGHNESS EFFECTS: HEAT TRANSFER AUGMENTATION (RUFSMT)	SURFACE ROUGHNESS EFFECTS: ROUGHNESS REYNOLDS NO (REKP)
1	1	0.0000	1.67902	0.0000	1.0000	10.0000	3.5784	0.000E+00
2	8	0.0694	1.67902	0.0006	1.0001	10.0000	2.5635	1.819E+03
3	15	0.1390	1.67902	0.0012	1.0000	10.0000	2.4825	2.160E+03
4	24	0.2675	1.67902	0.0014	1.0000	10.0000	2.0447	9.414E+02
5	28	0.4648	1.67901	0.0033	1.0000	10.0000	1.8808	6.987E+02
6	32	0.6697	1.67901	0.0064	1.0001	10.0000	1.8655	7.684E+02
7	37	0.9247	1.67901	0.0090	1.0001	10.0000	1.8269	7.233E+02
8	43	1.2287	1.67900	0.0118	1.0001	10.0000	1.7967	8.865E+02
9	49	1.5821	1.67900	0.0148	1.0002	10.0000	1.7700	6.504E+02
10	67	2.6929	1.67897	0.0236	1.0004	10.0000	1.7245	5.979E+02
11	83	3.7027	1.67893	0.0311	1.0007	10.0000	1.7005	5.726E+02
12	107	5.2175	1.67886	0.0417	1.0012	10.0000	1.6760	5.466E+02
13	131	6.7322	1.67876	0.0517	1.0020	10.0000	1.6588	5.288E+02

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0000 SEC

—— INITIAL CONDUCTION TIME STEPS ——

TIME STEP TO NEXT USER SPECIFIED TIME SEC (DLTOUT)	TIME STEP TO PRODUCE DESIRED SURFACE TEMPERATURE CHANGE SEC (DLTIS)	EXPLICIT STABILITY TIME STEP SEC (DLTC,
1.0000E-02	1.4229E-03	6.9277E-03

- - - - - - - - - - - - - - CONDUCTION TIME STEPS COMPUTED - - - - - - - - - - - - - -

SHAPE NO	TIME (SEC)	STAG PT RECESS (INCH)	STAG PT REC RATE (IN/SEC)	STAG PT TEMP (DEG R)	TIME STEP USED (SEC)	NEXT SPEC PRINT TIME (SEC)	EXPLICIT STABILITY (SEC)	HEAT FLUX CHANGE (SEC)	SURF TEMP CHANGE (SEC)	LAT COND STABILITY (SEC)	HA' N . IMPLICIT THICKNESS (SEC)
2	0.00	0.451	9.116E-06	626.6	1.423E-03	1.000E-02	6.928E-03	0.000E+00	0.000E+00	1.491E-02	1.316E+03
3	0.00	0.451	1.071E-05	664.7	2.503E-03	8.577E-03	6.914E-03	6.928E-03	2.503E-03	1.516E-02	1.120E+03
4	0.01	0.451	1.279E-05	706.7	4.802E-03	6.074E-03	6.901E-03	6.914E-03	4.802E-03	1.516E-02	9.383E+02
5	0.01	0.451	1.326E-05	715.4	1.271E-03	1.271E-03	6.887E-03	6.163E-03	8.383E-03	1.516E-02	9.050E+02

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0100 SEC

TEMPERATURES IN SURFACE LAYER,DEG R (TT)

	SURFACE MATERIAL INDEX	1	2	3	4	5	6	7	8	9	10	11
1	1	715.4	669.5	638.5	617.5	604.8	596.4	591.9	588.7	587.4	586.1	586.2
2	1	590.8	588.2	586.6	586.1	585.7	585.5	585.4	585.3	585.2	585.2	585.2
3	1	585.3	585.2	585.1	585.1	585.1	585.0	585.0	585.0	585.0	585.0	585.0
4	1	584.7	584.8	584.9	584.9	584.9	585.0	585.0	585.0	585.0	585.0	585.0
5	1	585.4	585.3	585.3	585.2	585.2	585.1	585.1	585.1	585.1	585.0	585.0
6	1	585.6	585.4	585.3	585.2	585.2	585.1	585.1	585.1	585.0	585.0	585.0
7	1	585.6	585.4	585.3	585.2	585.1	585.1	585.0	585.0	585.0	585.0	585.0
8	1	585.7	585.4	585.3	585.2	585.1	585.0	585.0	585.0	585.0	585.0	585.0
9	2	585.4	585.3	585.2	585.2	585.1	585.1	585.0	585.0	585.0	585.0	585.0
10	2	585.5	585.3	585.2	585.2	585.1	585.1	585.0	585.0	585.0	585.0	585.0
11	2	585.6	585.4	585.3	585.2	585.1	585.1	585.1	585.0	585.0	585.0	585.0
12	2	585.7	585.5	585.3	585.2	585.1	585.1	585.1	585.0	585.0	585.0	585.0
13	2	585.8	585.6	585.4	585.3	585.2	585.1	585.1	585.0	585.0	585.0	585.0

SURFACE LAYER NODELET MATERIAL INDICES (IMAT)

	1	2	3	4	5	6	7	8	9	10	11
1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1
9	2	2	2	2	1	1	1	1	1	1	2
10	2	2	2	2	2	2	2	2	2	2	2
11	2	2	2	2	2	2	2	2	2	2	2
12	2	2	2	2	2	2	2	2	2	2	2
13	2	2	2	2	2	2	2	2	2	2	2

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0100 SEC

INTERNAL EXPLICIT NODE FLAGS (NREG)

	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
22	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
21	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0
20	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
19	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1
18	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1
17	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
16	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
15	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
14	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	2	2	2	2	2	2	2	2	2	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	2	2	2	2	2	2	2	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	2	2	2	2	2	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	2	2	2	2	2	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	[illegible]		
1	2	2	2	2	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		

INTERNAL EXPLICIT NODE MATERIAL INDICES (NMAT)

	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
22	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
21	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
19	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
18	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
17	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
16	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
15	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
14	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	[illegible]	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
13	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	[illegible]	[illegible]	[illegible]	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
12	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	[illegible]	[illegible]	[illegible]	[illegible]	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
11	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	[illegible]	[illegible]	[illegible]	[illegible]	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
4	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0100 SEC

TEMPERATURES IN INTERNAL EXPLICIT GRID,DEG R (T)

	60	56	52	48	44	40	36	32	28	24	20	16	12	8	4
	59	55	51	47	43	39	35	31	27	23	19	15	11	7	3
	58	54	50	46	42	38	34	30	26	22	18	14	10	6	2
	57	53	49	45	41	37	33	29	25	21	17	13	9	5	1
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.5
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.3
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.2
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.2
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.7	585.1
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.5	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.3	585.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.2	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.1	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.6	585.1	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.4	585.0	585.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.3	585.0	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.2	585.0	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.1	585.0	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.5	585.1	585.0	585.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.4	585.0	585.0	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.2	585.0	585.0	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.1	585.0	585.0	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.1	585.0	585.0	585.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.6	585.1	585.0	585.0	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.3	585.0	585.0	585.6	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.2	585.0	585.0	585.0	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.1	585.0	585.0	585.0	585.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.1	585.0	585.0	585.0	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.5	585.0	585.0	585.0	585.0	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.3	585.0	585.0	585.0	585.0	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.2	585.0	585.0	585.0	585.0	585.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.1	585.0	585.0	585.0	585.0	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.1	585.0	585.0	585.0	585.0	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.4	585.0	585.0	585.0	585.0	585.0	585.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.2	585.0	585.0	585.0	585.0	585.0	585.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.2	585.0	585.0	585.0	585.0	585.0	585.0

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

```
                                                                       TIME =   0.0100 SEC
       0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0  585.1  585.0  585.0  585.0  585.0  585.0  585.0
         0.0    0.0    0.0    0.0    0.0    0.0    0.0  585.5  585.1  585.0  585.0  585.0  585.0  585.0  585.0
           0.0    0.0    0.0    0.0    0.0    0.0    0.0  585.3  585.0  585.0  585.0  585.0  585.0  585.0  585.0

 12    0.0    0.0    0.0    0.0    0.0    0.0    0.0  585.2  585.0  585.0  585.0  585.0  585.0  585.0  585.0
         0.0    0.0    0.0    0.0    0.0    0.0    0.0  585.1  585.0  585.0  585.0  585.0  585.0  585.0  585.0
           0.0    0.0    0.0    0.0    0.0    0.0    0.0  585.1  585.0  585.0  585.0  585.0  585.0  585.0  585.0
             0.0    0.0    0.0    0.0    0.0    0.0  585.4  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0

 11    0.0    0.0    0.0    0.0    0.0    0.0  585.3  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
         0.0    0.0    0.0    0.0    0.0    0.0  585.2  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
           0.0    0.0    0.0    0.0    0.0    0.0  585.1  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
             0.0    0.0    0.0    0.0    0.0    0.0  585.1  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0

 10    0.0    0.0    0.0    0.0    0.0  585.4  585.1  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
         0.0    0.0    0.0    0.0    0.0    0.0  585.3  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
           0.0    0.0    0.0    0.0    0.0    0.0  585.2  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
             0.0    0.0    0.0    0.0    0.0  585.1  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0

  9    0.0    0.0    0.0    0.0    0.0  585.1  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
         0.0    0.0    0.0    0.0  585.4  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
           0.0    0.0    0.0    0.0    0.0  585.2  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
             0.0    0.0    0.0    0.0  585.1  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0

  8    0.0    0.0    0.0    0.0  585.1  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
         0.0    0.0    0.0    0.0  585.1  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
           0.0    0.0    0.0    0.0  585.4  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
             0.0    0.0    0.0    0.0  585.2  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0

  7    0.0    0.0    0.0  585.2  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
         0.0    0.0    0.0  585.1  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
           0.0    0.0    0.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
             0.0    0.0  585.4  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0

  6    0.0    0.0    0.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
         0.0    0.0  585.3  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
           0.0    0.0  585.1  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
             0.0    0.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0

  5    0.0    0.0  585.1  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
         0.0    0.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
           0.0    0.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
             0.0  585.2  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0

  4    0.0    0.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
         0.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
           0.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
             0.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0

  3    0.0    0.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
         0.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
           0.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
             0.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0  585.0
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PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME =   0.0100 SEC

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2     0.0   600.5   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0
        0.0   585.5   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0
          0.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0
            0.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0

1     0.0   634.5   585.0   585.6   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0
        0.0   586.5   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0
          0.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.9   585.0   585.0   585.0   585.0
            0.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0   585.0
```

PLANAR VERSION SRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0100 SEC

BODY POINT LOCATION AND SURFACE ENERGY BALANCE RESULTS

BODY PT NO (J)	AXIAL LENGTH INCH (ZSP)	RADIAL LENGTH INCH (RSP)	SURFACE TEMP DEG R (TSP)	TOTAL REC.SS RATE IN/SEC (SDOT)	EROSION RECESS RATE IN/SEC (SDOTE)	B-PRIME THERMOCHEM (BPSP)	EROSION MASS LOSS RATE LBM/SEC-FT2 (EMDOT)	HEAT TRANS COEFFICIENT LBM/FT2-SEC (RUCHSP)	RECOVERY ENTHALPY BTU/LBM (HRSP)	SURFACE PRESSURE ATM (PRESP)
1	0.4507	0.0000	715.4	0.0000	0.0000	2.135E-04	0.0000	2.164E+00	484.1	7.5493
2	0.4627	0.0684	590.8	0.0000	0.0000	1.259E-04	0.0000	1.001E+00	504.4	6.7234
3	0.4975	0.1286	585.3	0.0000	0.0000	1.230E-04	0.0000	1.144E+00	501.7	4.7482
4	0.6074	0.1953	584.7	0.0000	0.0000	1.227E-04	0.0000	4.113E-01	493.8	1.3149
5	0.8000	0.2380	585.4	0.0000	0.0000	1.231E-04	0.0000	3.376E-01	493.6	1.2691
6	1.0000	0.2823	585.6	0.0000	0.0000	1.232E-04	0.0000	3.857E-01	494.9	1.6029
7	1.2490	0.3375	585.6	0.0000	0.0000	1.232E-04	0.0000	3.613E-01	494.8	1.5925
8	1.5500	0.3798	585.7	0.0000	0.0000	1.232E-04	0.0000	3.395E-01	494.8	1.5766
9	1.9000	0.4290	585.4	0.0000	0.0000	1.231E-04	0.0000	3.177E-01	494.6	1.5418
10	3.0000	0.5836	585.5	0.0000	0.0000	1.231E-04	0.0000	2.841E-01	494.5	1.5128
11	4.0000	0.7241	585.6	0.0000	0.0000	1.232E-04	0.0000	2.672E-01	494.5	1.5040
12	5.5000	0.9349	585.7	0.0000	0.0000	1.232E-04	0.0000	2.499E-01	494.5	1.4910
13	7.0000	1.1458	585.8	0.0000	0.0000	1.233E-04	0.0000	2.379E-01	494.4	1.4815

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 0.0100 SEC

SUMMARY
****

ENVIRONMENT NO	SHAPE NO	TIME SEC
(NT)	(MT)	(TIMEP)
2	5	0.0100

FREESTREAM MACH NO	FREESTREAM UNIT RE NO 1/FT	STAGNATION PT ENTHALPY BTU/LBM	STAGNATION PT PRESSURE ATM	ISENTROPIC EXPONENT BEHIND SHOCK	NOSE RADIUS INCH	INVISCID SONIC STREAM LENGTH INCH
(AMACH)	(UR1)	(HT2)	(PT2)	(GAM2)	(RN)	(SSONIC)
2.34	1.6510E+07	551.7	7.549	1.383	0.1949	0.1342

STAGNATION POINT

SURFACE TEMPERATURE DEG R	RECESSION INCH	HEAT TRANSFER COEFFICIENT LBM/FT2-SEC	CURVED SHOCK HEAT TRANSFER AUG	TRANS PROXIMITY HEAT TRANSFER AUG	ROUGHNESS HEIGHT MIL
(TSTAGP)	(ZSTAGP)	(RUCH(1))	(HETAUG)	(RUFSMT(1))	(RUF(1))
715.4	0.0000	2.2524	1.0001	3.6439	10.0000

NOSETIP DRAG COEF NORM BY 2*RNI	SONIC STREAM LENGTH INCH	SONIC UNIT REYNOLDS NO 1/FT	AXIAL RECESSION AT R = 0.24 INCH INCH	TRANSITION STREAM LENGTH INCH
(CDRAG)	(SSTR)	(URESTR)	(ZSIDE)	(STRAN)
1.091	0.1402	1.4200E+07	0.0000	.298E-01

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 1.5000 SEC

SHAPE NO	TIME (SEC)	STAG PT RECESS (INCH)	STAG PT REC RATE (IN/SEC)	STAG PT TEMP (DEG R)	TIME STEP USED (SEC)	NEXT SPEC PRINT TIME (SEC)	EXPLICIT STABILITY (SEC)	HEAT FLUX CHANGE (SEC)	SURF TEMP CHANGE (SEC)	LAT COND STABILITY (SEC)	HALF IMPLICIT NODE THICKNESS (SEC)
					- - - - CONDUCTION TIME STEPS COMPUTED	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
240	1.51	0.451	1.283E-06	593.5	6.579E-03	2.500E-01	6.579E-03	1.253E-02	4.854E-01	3.363E-02	2.241E+03
241	1.51	0.451	6.310E-06	593.4	6.579E-03	2.434E-01	6.578E-03	8.443E-03	4.852E-01	3.363E-02	2.245E+03
242	1.52	0.451	6.298E-06	593.4	6.578E-03	2.368E-01	6.578E-03	8.443E-03	4.814E-01	3.363E-02	2.250E+03
243	1.53	0.451	6.285E-06	593.4	6.578E-03	2.303E-01	6.577E-03	8.442E-03	4.840E-01	3.363E-02	2.254E+03
244	1.53	0.451	6.272E-06	593.4	6.577E-03	2.237E-01	6.577E-03	8.441E-03	4.846E-01	3.363E-02	2.258E+03
245	1.54	0.451	6.260E-06	593.4	6.577E-03	2.171E-01	6.577E-03	8.441E-03	4.850E-01	3.363E-02	2.263E+03
246	1.55	0.451	6.247E-06	593.4	6.577E-03	2.105E-01	6.577E-03	8.441E-03	4.852E-01	3.363E-02	2.267E+03
247	1.55	0.451	6.235E-06	593.4	6.577E-03	2.040E-01	6.577E-03	8.441E-03	4.854E-01	3.363E-02	2.272E+03
248	1.56	0.451	6.223E-06	593.4	6.577E-03	1.974E-01	6.577E-03	8.440E-03	4.855E-01	3.363E-02	2.276E+03
249	1.57	0.451	6.210E-06	593.4	6.577E-03	1.908E-01	5.577E-03	8.440E-03	4.857E-01	3.363E-02	2.281E+03
250	1.57	0.451	6.198E-06	593.4	6.577E-03	1.842E-01	6.577E-03	8.440E-03	4.858E-01	3.363E-02	2.285E+03
251	1.58	0.451	6.186E-06	593.3	6.577E-03	1.776E-01	6.577E-03	8.440E-03	4.859E-01	3.363E-02	2.290E+03
252	1.59	0.451	6.173E-06	593.3	6.577E-03	1.711E-01	6.577E-03	8.440E-03	4.860E-01	3.363E-02	2.294E+03
253	1.59	0.451	6.161E-06	593.3	6.577E-03	1.645E-01	6.577E-03	8.440E-03	4.861E-01	3.363E-02	2.299E+03
254	1.60	0.451	6.149E-06	593.3	6.577E-03	1.579E-01	6.577E-03	8.440E-03	4.862E-01	3.363E-02	2.303E+03
255	1.61	0.451	6.137E-06	593.3	6.577E-03	1.513E-01	6.577E-03	8.440E-03	4.863E-01	3.363E-02	2.308E+03
256	1.51	0.451	6.125E-06	593.3	6.577E-03	1.448E-01	6.577E-03	8.440E-03	4.864E-01	3.363E-02	2.312E+03
257	1.62	0.451	6.113E-06	593.3	6.577E-03	1.382E-01	6.577E-03	8.440E-03	4.864E-01	3.363E-02	2.317E+03
258	1.62	0.451	6.101E-06	593.3	6.577E-03	1.316E-01	6.577E-03	8.440E-03	4.865E-01	3.363E-02	2.321E+03
259	1.63	0.451	6.090E-06	593.3	6.577E-03	1.250E-01	6.577E-03	8.440E-03	4.866E-01	3.363E-02	2.325E+03
260	1.64	0.451	6.078E-06	593.3	6.577E-03	1.185E-01	6.577E-03	8.440E-03	4.867E-01	3.363E-02	2.330E+03
261	1.64	0.451	6.067E-06	593.3	6.577E-03	1.119E-01	6.577E-03	8.440E-03	4.868E-01	3.363E-02	2.334E+03
262	1.65	0.451	6.055E-06	593.3	6.577E-03	1.053E-01	6.577E-03	8.441E-03	4.869E-01	3.363E-02	2.339E+03
263	1.66	0.451	6.044E-06	593.3	6.577E-03	9.873E-02	6.577E-03	8.441E-03	4.870E-01	3.363E-02	2.343E+03
264	1.66	0.451	6.032E-06	593.3	6.577E-03	9.215E-02	6.577E-03	8.441E-03	4.870E-01	3.363E-02	2.347E+03
265	1.67	0.451	6.021E-06	593.3	6.577E-03	8.557E-02	6.577E-03	8.441E-03	4.871E-01	3.363E-02	2.352E+03
266	1.68	0.451	6.010E-06	593.2	6.577E-03	7.899E-02	6.578E-03	8.441E-03	4.872E-01	3.363E-02	2.356E+03
267	1.68	0.451	5.998E-06	593.2	6.578E-03	7.242E-02	6.578E-03	8.441E-03	4.872E-01	3.363E-02	2.361E+03
268	1.69	0.451	5.987E-06	593.2	6.578E-03	6.584E-02	6.578E-03	8.441E-03	4.873E-01	3.363E-02	2.365E+03
269	1.70	0.451	5.976E-06	593.2	6.578E-03	5.926E-02	6.578E-03	8.441E-03	4.874E-01	3.363E-02	2.370E+03
270	1.70	0.451	5.964E-05	593.2	6.578E-03	5.268E-02	6.578E-03	8.441E-03	4.874E-01	3.363E-02	2.374E+03
271	1.71	0.451	5.953E-06	593.2	6.578E-03	4.611E-02	6.578E-03	8.442E-03	4.875E-01	3.363E-02	2.379E+03
272	1.72	0.451	5.942E-06	593.2	6.578E-03	3.953E-02	6.578E-03	8.442E-03	4.875E-01	3.363E-02	2.383E+03
273	1.72	0.451	5.931E-06	593.2	6.578E-03	3.295E-02	6.578E-03	8.442E-03	4.876E-01	3.363E-02	2.388E+03
274	1.73	0.451	5.919E-06	593.2	6.578E-03	2.637E-02	6.579E-03	8.442E-03	4.877E-01	3.363E-02	2.392E+03
275	1.74	0.451	5.908E-06	593.2	6.579E-03	1.979E-02	6.579E-03	8.442E-03	4.877E-01	3.363E-02	2.397E+03
276	1.74	0.451	5.897E-06	593.2	6.579E-03	1.321E-02	6.579E-03	8.442E-03	4.878E-01	3.363E-02	2.401E+03
277	1.75	0.451	5.886E-06	593.2	6.579E-03	6.636E-03	6.579E-03	8.443E-03	4.878E-01	3.363E-02	2.406E+03
278	1.75	0.451	6.748E-04	593.2	5.727E-05	5.727E-05	6.579E-03	8.443E-03	4.879E-01	3.364E-02	2.410E+03

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 1.7500 SEC

TEMPERATURES IN SURFACE LAYER, DEG R (TT)

	SURFACE MATERIAL INDEX	1	2	3	4	5	6	7	8	9	10	11
1	1	593.2	592.8	592.7	592.3	592.2	591.9	591.8	591.5	591.4	591.1	591.0
2	1	592.5	592.1	592.0	591.7	591.5	591.3	591.2	591.0	591.0	590.8	590.8
3	1	590.4	590.4	590.4	590.4	590.4	590.4	590.5	590.4	590.4	590.4	590.4
4	1	590.0	590.0	590.0	590.0	590.1	590.1	590.1	590.1	590.1	590.1	590.1
5	1	590.6	590.6	590.6	590.6	590.5	590.5	590.5	590.4	590.4	590.3	590.3
6	1	590.9	590.8	590.8	590.7	590.7	590.6	590.5	590.4	590.4	590.3	590.2
7	1	591.1	590.9	590.9	590.7	590.6	590.5	590.4	590.3	590.2	590.1	590.0
8	1	590.8	590.6	590.6	590.4	590.3	590.2	590.1	589.9	589.9	589.7	589.7
9	2	590.4	590.3	590.3	590.2	590.2	590.0	589.9	589.8	589.7	589.5	589.5
10	2	589.6	589.5	589.5	589.4	589.3	589.2	589.2	589.1	589.1	589.0	588.9
11	2	589.5	589.4	589.4	589.2	589.2	589.1	589.0	588.9	588.9	588.7	588.7
12	2	590.2	590.0	590.0	589.8	589.8	589.6	589.6	589.4	589.4	589.2	589.2
13	2	591.4	591.2	591.1	591.0	590.9	590.7	590.7	590.5	590.4	590.2	590.2

SURFACE LAYER NODELET MATERIAL INDICES (IMAT)

	1	2	3	4	5	6	7	8	9	10	11
1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1
9	2	2	2	2	1	1	1	1	1	1	2
10	2	2	2	2	2	2	2	2	2	2	2
11	2	2	2	2	2	2	2	2	2	2	2
12	2	2	2	2	2	2	2	2	2	2	2
13	2	2	2	2	2	2	2	2	2	2	2

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 1.7500 SEC

INTERNAL EXPLICIT NODE FLAGS (NREG)

	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
22	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
21	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0
20	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0
19	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1
18	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1
17	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
16	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
15	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
14	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	2	2	2	2	2	2	2	2	2	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	2	2	2	2	2	2	2	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	2	2	2	2	2	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	2	2	2	2	2	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	2	2	2	2	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

INTERNAL EXPLICIT NODE MATERIAL INDICES (NMAT)

	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
22	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
21	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
19	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
18	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
17	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
16	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
15	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
14	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
13	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
12	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
11	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
4	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 1.7500 SEC

TEMPERATURES IN INTERNAL EXPLICIT GRID,DEC R (T)

```
         60      56      52      48      44      40      36      32      28      24      20      16      12       8       4
           59      55      51      47      43      39      35      31      27      23      19      15      11       7       3
             58      54      50      46      42      38      34      30      26      22      18      14      10       6       2
               57      53      49      45      41      37      33      29      25      21      17      13       9       5       1

 22     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
          0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
            0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
              0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

 21     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
          0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   591.0
            0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   591.0
              0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   590.9

 20     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   590.6
          0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   590.8   590.5
            0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   590.7   590.4
              0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   590.6   590.4

 19     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   590.3   590.0
          0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   590.3   590.1
            0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   590.4   590.2   590.0
              0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   590.4   590.1   590.0

 18     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   590.1   589.8   589.7
          0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   590.0   589.7   589.7
            0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.9   589.8   589.7
              0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   590.1   589.9   589.8   589.7

 17     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.9   589.6   589.5   589.4
          0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.8   589.5   589.4   589.4
            0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.7   589.5   589.4   589.3
              0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.6   589.5   589.4   589.3

 16     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.8   589.5   589.3   589.1   589.0
          0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.7   589.3   589.2   589.1   589.0
            0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.6   589.2   589.2   589.1   589.0
              0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.5   589.3   589.2   589.1   589.0

 15     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.4   589.1   588.9   588.8   588.7
          0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.6   589.3   589.0   588.9   588.8   588.7
            0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.5   589.2   589.0   588.9   588.7   588.6
              0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.5   589.1   589.0   588.8   588.7   588.6

 14     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.3   589.0   588.8   588.6   588.5   588.4
          0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.2   589.0   588.7   588.6   588.5   588.3
            0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.4   589.1   588.9   588.7   588.6   588.4   588.3
              0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.3   589.1   588.8   588.7   588.5   588.4   588.3

 13     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   589.3   588.9   588.7   588.5   588.3   588.2   588.1
```

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 1.7500 SEC

	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	589.2	588.8	588.7	588.5	588.3	588.1	588.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	589.5	589.0	588.8	588.6	588.4	588.3	588.1	588.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	589.4	589.0	588.8	588.6	588.4	588.2	588.1	588.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	589.4	588.9	588.6	588.4	588.2	588.1	587.9	587.8
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	589.3	588.8	588.6	588.4	588.2	588.0	587.9	587.7
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	589.2	588.8	588.6	588.3	588.1	588.0	587.8	587.7
	0.0	0.0	0.0	0.0	0.0	0.0	589.5	589.1	588.7	588.5	588.3	588.1	587.9	587.8	587.7
11	0.0	0.0	0.0	0.0	0.0	0.0	589.6	589.1	588.7	588.4	588.2	588.0	587.8	587.6	587.5
	0.0	0.0	0.0	0.0	0.0	0.0	589.4	589.0	588.6	588.3	588.1	587.9	587.8	587.6	587.5
	0.0	0.0	0.0	0.0	0.0	0.0	589.3	588.8	588.5	588.3	588.1	587.9	587.7	587.6	587.5
	0.0	0.0	0.0	0.0	0.0	0.0	589.2	588.8	588.5	588.2	588.0	587.8	587.7	587.5	587.5
10	0.0	0.0	0.0	0.0	0.0	590.1	589.3	588.8	588.4	588.2	587.9	587.7	587.6	587.4	587.3
	0.0	0.0	0.0	0.0	0.0	589.9	589.1	588.7	588.3	588.1	587.9	587.7	587.5	587.4	587.2
	0.0	0.0	0.0	0.0	0.0	589.7	589.0	588.6	588.3	588.1	587.8	587.6	587.5	587.3	587.2
	0.0	0.0	0.0	0.0	0.0	589.5	588.9	588.5	588.2	588.0	587.8	587.6	587.4	587.3	587.2
9	0.0	0.0	0.0	0.0	0.0	589.7	589.1	588.6	588.2	587.9	587.7	587.5	587.3	587.2	587.0
	0.0	0.0	0.0	0.0	590.3	589.5	588.9	588.5	588.1	587.9	587.7	587.5	587.3	587.1	587.0
	0.0	0.0	0.0	0.0	590.1	589.3	588.8	588.4	588.1	587.8	587.6	587.4	587.2	587.1	587.0
	0.0	0.0	0.0	0.0	589.9	589.1	588.7	588.3	588.0	587.8	587.6	587.4	587.2	587.1	587.0
8	0.0	0.0	0.0	0.0	590.2	589.3	588.8	588.4	588.0	587.8	587.5	587.3	587.1	587.0	586.8
	0.0	0.0	0.0	0.0	589.9	589.3	588.7	588.3	588.0	587.7	587.5	587.3	587.1	586.9	586.8
	0.0	0.0	0.0	590.6	589.7	589.1	588.6	588.2	587.9	587.5	587.4	587.2	587.0	586.9	586.8
	0.0	0.0	0.0	590.4	589.5	588.9	588.5	588.1	587.8	587.6	587.4	587.2	587.0	586.9	586.8
7	0.0	0.0	0.0	590.6	589.7	589.1	588.7	588.2	587.9	587.6	587.4	587.1	587.0	586.8	586.7
	0.0	0.0	0.0	590.3	589.4	589.1	588.5	588.1	587.8	587.5	587.3	587.1	586.9	586.8	586.6
	0.0	0.0	0.0	590.1	589.5	588.9	588.4	588.0	587.7	587.5	587.2	587.0	586.9	586.7	586.6
	0.0	0.0	590.8	589.8	589.3	588.8	588.3	587.9	587.6	587.4	587.2	587.0	586.8	586.7	586.6
6	0.0	0.0	0.0	590.1	589.4	589.0	588.5	588.1	587.7	587.4	587.2	587.0	586.8	586.6	586.5
	0.0	0.0	590.7	589.8	589.3	588.9	588.4	588.0	587.6	587.4	587.1	586.9	586.8	586.6	586.5
	0.0	0.0	590.5	589.7	589.2	588.8	588.3	587.9	587.6	587.3	587.1	586.9	586.7	586.6	586.5
	0.0	0.0	590.3	589.4	589.1	588.6	588.2	587.8	587.5	587.3	587.0	586.9	586.7	586.5	586.5
5	0.0	0.0	590.4	589.7	589.2	588.8	588.4	587.9	587.6	587.3	587.1	586.9	586.7	586.5	586.4
	0.0	0.0	590.2	589.5	589.1	588.7	588.2	587.8	587.5	587.2	587.0	586.8	586.6	586.5	586.4
	0.0	0.0	590.2	589.3	589.1	588.6	588.1	587.7	587.4	587.2	587.0	586.8	586.6	586.5	586.4
	0.0	590.5	590.0	589.2	589.0	588.5	588.0	587.7	587.4	587.1	586.9	586.7	586.6	586.4	586.4
4	0.0	0.0	590.1	589.3	589.0	588.7	588.3	587.8	587.5	587.2	587.0	586.8	586.6	586.4	586.3
	0.0	590.2	590.0	589.0	589.0	588.6	588.1	587.7	587.4	587.1	586.9	586.7	586.5	586.4	586.3
	0.0	590.2	589.8	588.9	588.9	588.5	588.0	587.6	587.3	587.1	586.9	586.7	586.5	586.4	586.3
	0.0	590.2	589.7	589.0	588.8	588.4	587.9	587.6	587.3	587.0	586.8	586.6	586.5	586.3	586.3
3	0.0	0.0	589.9	588.9	588.9	588.6	588.2	587.6	587.4	587.1	586.9	586.7	586.5	586.4	586.2
	0.0	590.5	589.8	588.7	588.9	588.5	588.1	587.7	587.3	587.1	586.8	586.6	586.5	586.3	586.2
	0.0	590.2	589.6	588.6	588.8	588.4	588.0	587.6	587.3	587.0	586.8	586.6	586.4	586.3	586.2
	0.0	590.1	589.2	588.9	588.8	588.3	587.8	587.5	587.2	587.0	586.7	586.6	586.4	586.3	586.2

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 1.7500 SEC

2	0.0	592.2	589.8	588.8	588.8	588.6	588.1	587.7	587.4	587.1	586.9	586.6	586.5	586.3	586.2
	0.0	590.7	589.6	588.6	588.8	588.5	588.0	587.6	587.3	587.0	586.8	586.6	586.4	586.3	586.2
	0.0	590.2	589.4	588.6	588.8	588.4	587.9	587.5	587.2	587.0	586.7	586.6	586.4	586.2	586.2
	0.0	590.0	589.1	588.8	588.7	588 2	587.8	587.4	587.1	586.9	586.7	586.5	586.3	586.2	586.2
1	0.0	592.6	589.8	588.8	588.8	588.6	588.1	587.7	587.3	587.1	586.8	586.6	586.5	586.3	586.2
	0.0	590.8	589.6	588.6	588.8	588.5	588.0	587.6	587.3	587.0	586.8	586.6	586.4	586.3	586.2
	0.0	590.2	589.4	588.6	588.8	588.4	537.9	587.5	587.2	587.0	586.7	586.5	586.4	586.2	586.2
	0.0	589.9	589.1	588.8	588.7	588.2	587.8	587.4	587.1	586.9	586.7	586.5	586.3	586.2	586.2

PLANAR VERSION BRL IMPROVED ABRES SHAPE CHANGE CODE (PLNARASCC)

TIME = 1.7500 SEC

BODY POINT LOCATION AND SURFACE ENERGY BALANCE RESULTS

****

BODY PT NO (J)	AXIAL LENGTH INCH (ZSP)	RADIAL LENGTH INCH (RSP)	SURFACE TEMP DEG R (TSP)	TOTAL RECESS RATE IN/SEC (SDOT)	EROSION RECESS RATE IN/SEC (SDOTE)	B-PRIME THERMOCHEM (BPSP)	EROSION MASS LOSS RATE LBM/SEC-FT2 (EMDOT)	HEAT TRANS COEFFICIENT LBM/FT2-SEC (RUCHSP)	RECOVERY ENTHALPY BTU/LBM (HRSP)	SURFACE PRESSURE ATM (PRESP)
1	0.4509	0.0000	593.2	0.0007•	0.0000	2.135E-04•	0.0000	1.527E+00	264.9	4.3255
2	0.4627	0.0684	592.5	0.0000	0.0000	1.268E-04	0.0000	1.368E+00	265.1	3.8761
3	0.4975	0.1286	590.4	0.0000	0.0000	1.257E-04	0.0000	7.317E-01	273.7	2.5752
4	0.6074	0.1953	590.0	0.0000	0.0000	1.255E-04	0.0000	2.553E-01	268.1	0.7038
5	0.8000	0.2380	590.6	0.0000	0.0000	1.258E-04	0.0000	2.627E-01	268.9	0.8709
6	1.0000	0.2823	590.9	0.0000	0.0000	1.260E-04	0.0000	3.003E-01	269.9	1.1168
7	1.2490	0.3375	591.1	0.0000	0.0000	1.261E-04	0.0000	2.854E-01	269.9	1.1317
8	1.5500	0.3798	590.8	0.0000	0.0009	1.259E-04	0.0000	2.810E-01	270.1	1.1915
9	1.9000	0.4290	590.4	0.0000	0.0000	1.257E-04	0.0000	2.661E-01	270.1	1.1821
10	3.0000	0.5036	589.6	0.0000	0.0000	1.253E-04	0.0000	2.409E-01	270.1	1.1815
11	4.0000	0.7241	589.5	0.0000	0.0000	1.252E-04	0.0000	2.272E-01	270.1	1.1810
12	5.5000	0.9349	590.2	0.0000	0.0000	1.256E-04	0.0000	2.134E-01	270.1	1.1802
13	7.0060	1.1458	591.4	0.0000	0.0000	1.262E-04	0.0000	2.037E-01	270.1	1.1794

NORMAL COMPONENT OF MACH NUMBER IS OUT OF RANGE. AMACH = 1.73132

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NOMENCLATURE

H	convective heat transfer coefficient in Figures 2-5 through 2-11
Λ	swept wing angle measured from a normal to the flow direction
M_∞	freestream Mach number
P	static pressure
P_o	stagnation pressure
Re	Reynolds number
R_i	nose radius on cylinder/wedge swept wing
S	distance along surface measured normal to the wing leading edge
T	static temperature
T_o	stagnation temperature
X	axial distance measured normal to the wing leading edge
θ_w	aft wedge angle on cylinder/wedge swept wing

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